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THICKNESS and PACKING FRACTION OF AMMONIA USED IN SLAC E143 EXPERIMENT

by

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Thickness and Packing Fraction of Ammonia Used in SLAC E143 Experiment

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15 August, 1994

Abstract

The ammonia target thickness used in the E143 "Nucleon Spin Structure" experiment has been determined by the attenuation of 60 keV x-rays from ^{241}Am. The ammonia thickness and packing fraction for each target has been measured to an accuracy of better than 0.6%. Target thickness profiles for each of the targets are also presented.

1. GENERAL

1.1 Introduction

The E143 "Nucleon Spin Structure" experiment used a polarized solid ammonia target as a source of polarized proton scattering centers. A value for the thickness of ammonia is necessary to derive the dilution factor "F", which is the ratio of the probability of scattering only from free protons to the probability of scattering from any nucleon in the target assembly. The dilution factor is used to determine the longitudinal asymmetry, "A_{long}":

$$A_{\mathrm{long}} = \frac{A_{\mathrm{exp}}}{P_{\mathrm{B}} P_{\mathrm{T}} F(1+C)} = \frac{\sigma^{\uparrow\downarrow} - \sigma^{\uparrow\uparrow}}{\sigma^{\uparrow\downarrow} + \sigma^{\uparrow\uparrow}}, \tag{1a}$$

or, equivalently,

$$A_{\mathrm{exp}} = A_{\mathrm{long}}\left[P_{\mathrm{B}} P_{\mathrm{T}} F(1+C)\right] = \frac{N^{\uparrow\downarrow} - N^{\uparrow\uparrow}}{N^{\uparrow\downarrow} + N^{\uparrow\uparrow}}, \tag{1b}$$

where "P_B" refers to the beam polarization; "P_T" refers to the target polarization; "C" is a correction for the effects of polarization of the unpaired proton in ^{15}N ; "sigma" is the polarized scattering cross section and "N" is the observed number of scattering events for the specified orientation of the beam and target polarization's, (opposite, $\uparrow\downarrow$, or or parallel, $\uparrow\uparrow$). Further discussion of the meaning of the longitudinal asymmetry and how it is used to derive the spin-dependent structure functions $g_1(x)$ and $g_2(x)$ is contained in the E143 proposal (MCC93). X-ray intensities are used to measure the thickness and resultant packing fraction for the ammonia targets. Reference values for the attenuation coefficients are generated by the program PHOTCOEF (AIC93).

The target used in End Station "A" (ESA) at SLAC for E143 contained grains of frozen ammonia that had been "radiation damaged" to produce "color centers" at various electron beam facilities including the Massachusetts Institute of Technology (MIT) Bates Laboratory, Stanford High Energy Physics Lab (HEPL), Naval Postgraduate

School (NPS) and Saskatchewan Accelerator Laboratory (SAL). The ammonia in the target is bombarded with microwaves at a frequency to cause spin-flip transitions to polarized states around the color centers. The target material and apparatus are described further by the target group (CRA90). The basic experimental setup of E143 in ESA is illustrated in Figure 1.

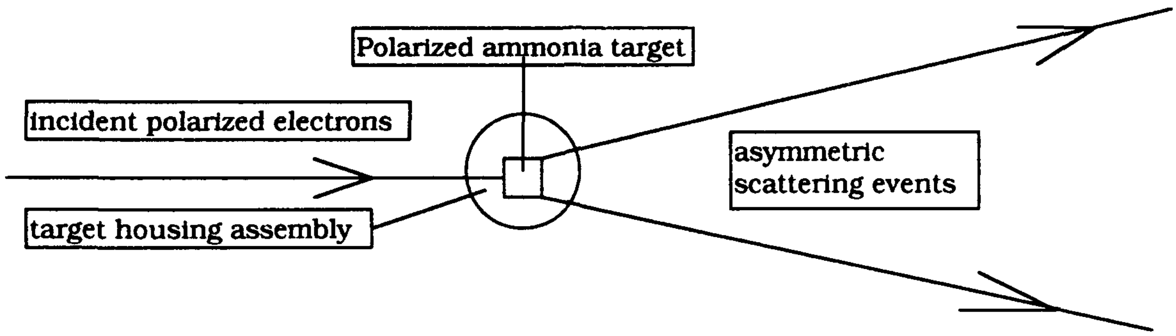

Figure 1. E143 experiment schematic

The ammonia target thickness measurements were made at SLAC from September 1993 through February 1994, by the NPS group and other members of the E143 Collaboration (SHA93), (SIC93).

1.2 Descriptive analysis of electromagnetic radiation attenuation in matter

A schematic representation of the quantities of interest is given in Figure 2.

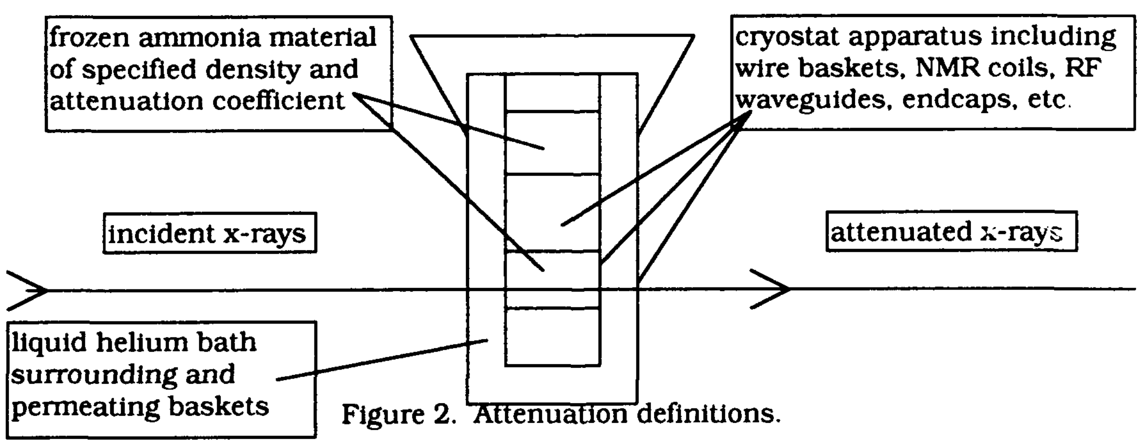

Figure 2. Attenuation definitions.

The following is a list of symbolic notation for the quantities defined in Figure 2:

$t_y \equiv$ effective linear thickness of material "y" in cm

t_{trgt} = stick cell measured value: 3.00 ± 0.03 cm

t_{amm} = effective linear thickness of ammonia in target cell

$$\rho_y \equiv \text{mass density of material "y" in } \frac{\text{grams}}{\text{cm}^3}$$

$$x_y \equiv \rho_y t_y \equiv \text{mass thickness of material "y" in } \frac{\text{grams}}{\text{cm}^2}$$

x_{He} = thickness of ^{4}He outside target cell

x'_{He} = thickness of ^{4}He inside target cell

x_{cryo} = thickness of cryostat, target assembly, etc.

x_{amm} = mass thickness of ammonia in target cell

$\mu_y \equiv$ linear attenuation coefficient of "y" in cm^{-1}

$$\left(\mu/\rho\right)_y \equiv \text{mass attenuation coefficient of "y" in } \frac{\text{cm}^2}{\text{gram}}$$

$f_y \equiv$ volume packing fraction of material "y"

$$f_{amm} = \text{ammonia fraction of target volume} = \frac{t_{amm}}{t_{trgt}} = \frac{x_{amm}}{\rho_{amm} t_{trgt}}$$

The mass-attenuation coefficients are calculated by identifying the target material by chemical symbol and defining the incident x-ray energy from the Americium 241 source as 59.53 keV. The calculated value for the mass attenuation coefficient for helium is

$$\left(\mu/\rho\right)_{^4He} = 0.16534 \frac{\text{cm}^2}{\text{gram}} \text{ at } 59.53 \text{ keV}$$

PHOTCOEF gives value for "normal" chemical compounds only and a correction is required for ammonia of different isotopic compositions. The photon interaction is an electromagnetic process governed by the charge distribution of a scattering center (molecule in this case). The actual values of the mass-attenuation coefficients, however, are derived in terms of interaction cross section per unit mass.

$$\left(\mu/\rho\right) \equiv \frac{n\sigma}{\rho} \equiv N_{Av}\left(\frac{\sigma}{A}\right) \equiv \frac{\text{cross section}}{\text{unit mass}} \quad \text{(2a)}$$

where A is the molecular weight and N_{Av} is Avogadro's number of scattering centers per mole of substance. Expanding upon this definition, we derive an expression for the mass-attenuation coefficients for $^{15}NH_3$ and $^{15}ND_3$ in terms of the mass-attenuation coefficient for $^{14}NH_3$:

$$\left[\frac{\mu_{^{15}NH_3}}{\rho_{^{15}NH_3}}\right] \equiv \left[\frac{\mu_{^{15}NH_3}}{\mu_{^{14}NH_3}}\right]\left[\frac{\rho_{^{14}NH_3}}{\rho_{^{15}NH_3}}\right]\left[\frac{\mu_{^{14}NH_3}}{\rho_{^{14}NH_3}}\right] = \left[\frac{(n\sigma)_{^{15}NH_3}}{(n\sigma)_{^{14}NH_3}}\right]\left[\frac{\rho_{^{14}NH_3}}{\rho_{^{15}NH_3}}\right]\left[\frac{\mu_{^{14}NH_3}}{\rho_{^{14}NH_3}}\right], \quad \text{(2b)}$$

$$\text{where } n_y \equiv N_{Av}\left(\frac{\rho}{A}\right)_y = \text{Number of center per unit volume}$$

The assumption that the scattering amplitudes are proportional to the charge distribution of the scattering center, independent of its mass, is expressed by assuming that the scattering cross sections are equal i.e.,

$$\sigma_{^{15}NH_3} \equiv \sigma_{^{14}NH_3}.$$

$$\Rightarrow \left[\frac{\mu_{^{15}NH_3}}{\rho_{^{15}NH_3}}\right] = \left[\frac{\rho_{^{15}NH_3}}{\rho_{^{14}NH_3}}\right]\left[\frac{A_{^{14}NH_3}}{A_{^{15}NH_3}}\right]\left[\frac{\rho_{^{14}NH_3}}{\rho_{^{15}NH_3}}\right]\left[\frac{\mu_{^{14}NH_3}}{\rho_{^{14}NH_3}}\right] = \left[\frac{A_{^{14}NH_3}}{A_{^{15}NH_3}}\right]\left[\frac{\mu_{^{14}NH_3}}{\rho_{^{14}NH_3}}\right]. \quad \text{(3)}$$

Note that it is the ratio of the molecular weights that determines the isotopic mass-attenuation coefficient. For "normal" ammonia

$$\left(\mu/\rho\right)_{^{14}NH_3} = 0.20798 \frac{\text{cm}^2}{\text{gram}} \text{ at } 59.53 \text{ keV}.$$

From this value, we obtained the mass-attenuation coefficient for the isotopes used in the experiment corrected by the ratio of the number of nucleons. Binding energy corrections are negligible, amounting to less than 0.05% (WIL84).

$$\left(\mu/\rho\right)_{^{15}NH_3} = \left(17/18\right)\left(\mu/\rho\right)_{^{14}NH_3} = 0.19643 \frac{\text{cm}^2}{\text{gram}}.$$

$$\left(\mu/\rho\right)_{^{15}ND_3} = \left(17/21\right)\left(\mu/\rho\right)_{^{14}NH_3} = 0.16836\frac{cm^2}{gram}$$

The mass density values used throughout our calculations are:

$$\rho_{He} = 0.128 \pm 0.003\ \frac{grams}{cm^3}\ \text{at } 4.0 \pm 0.1°\ K$$

$$\rho_{^{15}NH_3} = 0.917 \pm 0.001\ \frac{grams}{cm^3}\ \text{at } 4.0 \pm 0.1°\ K$$

$$\rho_{^{15}ND_3} = 1.056 \pm 0.001\ \frac{grams}{cm^3}\ \text{at } 4.0 \pm 0.1°\ K$$

These ammonia densities were supplied by the UVA. target group (LMS93) and the helium value is for normal liquid helium at vapor pressure and the specified temperature (PVM93). The uncertainty in the temperature is a conservative estimate and the densities apply within the specified temperature range.

1.3 Relationships between experimental quantities

There are two experimental configurations which must be considered. In the first setup, the cryostat assembly is full of helium at 4 K with a target stick inserted. The x-ray beam is scanned across the face of a cell that contains the unknown thickness of solid ammonia. The second setup is identical except that the ammonia crystals have been removed and the target cell is empty. The exposure time for both configurations is the same, so Poisson statistics apply (TAY82). The resultant x-ray intensities, "I_{amm}" and "I_{empty}", after traversing the targets are:

$$I_{amm} = I_0 e^{-\left\{\left(\mu/\rho\right)_{cryo} x_{cryo} + \left(\mu/\rho\right)_{He}\left(x_{He} + x'_{He}\right) + \left(\mu/\rho\right)_{amm} x_{amm}\right\}}$$

$$I_{empty} = I_0 e^{-\left\{\left(\mu/\rho\right)_{cryo} x_{cryo} + \left(\mu/\rho\right)_{He}\left(x_{He} + x'_{He} + x_{amm}\right)\right\}}$$

The terms with the subscript "cryo" refer to the effects of the experimental apparatus and include all support structure, NMR coils, wire baskets, etc. These are too complex

to be easily evaluated but they are identical for both situations. Consequently, taking the ratio cancels their effects:

$$\left(\frac{I_{empty}}{I_{amm}}\right) = e^{-f_{amm} t_{trgt} \rho_{amm} \left(\left(\rho_{He} / \rho_{amm} \right) \left(\mu / \rho \right)_{He} - \left(\mu / \rho \right)_{amm} \right)} \quad . \tag{4}$$

Taking the logarithm of each side and rearranging terms gives the desired expression for the **volume packing fraction** in a target cell.

$$f_{amm} = \frac{\ell n \left(I_{empty} / I_{amm} \right)}{t_{trgt} \rho_{amm} \left(\left(\mu / \rho \right)_{amm} - \left(\rho_{He} / \rho_{amm} \right) \left(\mu / \rho \right)_{He} \right)} \quad . \tag{5}$$

The denominator in this expression can be computed independently of the x-ray measurement and has values of 0.47689 for the NH_3 and 0.46988 for the ND_3. The **mass-thickness** of ammonia in a target cell is consequently:

$$x_{amm} = t_{trgt} \rho_{amm} f_{amm} = \frac{\ell n \left(I_{empty} / I_{amm} \right)}{\left(\left(\mu / \rho \right)_{amm.} - \left(\rho_{He} / \rho_{amm} \right) \left(\mu / \rho \right)_{He} \right)} \quad . \tag{6}$$

The denominator has a value of 0.17335 for the NH_3 and 0.14832 for the ND_3. Note that the effective mass-attenuation coefficient of helium in the denominator is supressed relative to the mass-attenuation coefficient of ammonia by a factor of the ratio of their densities (<0.143). Thus while each mass-attenuation coefficients iscomparable in magnitude, the ammonia term contributes (1/0.143)=7 times more in the denominator. This observation will have implications in the next section.

1.4 Error analysis

We assume that if x,..., z are measurements used to compute the function q(x,..., z), and if the uncertainties in x,..., z are independent and random, then the uncertainty in the computed function q is given by (TAY82):

$$\delta q = \sqrt{\left(\frac{\partial q}{\partial x}\delta x\right)^2 + \ldots + \left(\frac{\partial q}{\partial z}\delta z\right)^2} \quad (7)$$

We treat the intensity measurements as satisfying equation (7). The uncertainty in the packing fraction, equation (5), and the mass-thickness, equation (6), result from uncertainties in the attenuation coefficients, material densities and the x-ray intensity measurements which are independent variables. The largest source of uncertainty is the calculated mass-attenuation coefficient for ammonia. This uncertaintey, however, is not random, but is a contribution to the systematic error.The contribution from the ammonia mass-attenuation coefficient is seven times more significant than that from helium. The accurate knowledge of the x-ray energy is also less significant. We maintain four digits of accuracy rather than round the source energy up to 60 keV but the effect of lack of precision in the x-ray energy is minimal. For example, using 60.00 keV, which is 0.8% higher than the actual x-ray energy, the denominator in equation (6) becomes 0.17400 resulting in a 0.4% decrease in thickness.. Ignoring the systematic errors, the fractional uncertainty in the mass-thickness is:

$$\frac{\delta x_{amm}}{x_{amm}} = \frac{\sqrt{\left(\frac{\delta I_{empty}}{I_{empty}}\right)^2 + \left(\frac{\delta I_{amm}}{I_{amm}}\right)^2}}{\ell n\left(I_{empty}/I_{amm}\right)} \quad (8)$$

Since identical counting times were used, we may evaluate the uncertainty in intensities the square root of the number of counts.

$$\left(\frac{\delta I_x}{I_x}\right)^2 = \left(\frac{\sqrt{I_x}}{I_x}\right)^2 = \left(\frac{1}{\sqrt{I_x}}\right)^2 = \frac{1}{I_x} \quad (9)$$

Combining these terms under the radical using the identity:

$$\frac{1}{I_x} + \frac{1}{I_y} \equiv \frac{I_x + I_y}{I_x I_y} \quad (10)$$

A final expression for the fractional uncertainty in the mass-thickness is:

$$\frac{\delta x_{amm}}{x_{amm}} = \frac{\sqrt{\left(I_{empty} + I_{amm}\right)/\left(I_{empty} I_{amm}\right)}}{\ell n\left(I_{empty}/I_{amm}\right)} \quad . \tag{11}$$

The quantities of interest, mass-thickness and volume packing fraction, describe all of the material in a given basket. This means that the intensities used for our calculations are the sums of the 21 intensities from each scan position. This greatly improves the overall accuracy as point to point fluctuations are averaged throughout the entire volume of a cell. Note that the difference between the average of the logarithms of the intensity ratios and the logarithm of the average of the intensity ratios is within 0.6%. The statistical error on the final values ranges from 0.85% to 1.3%. The systematic uncertainty in the computer tabulated values of the attenuation cross sections are not well established experimentally, but theoretically, for small Z, they are expected to be in the 2-5% range (MCM67).

2. MEASUREMENT

2.1 Preparations

The ammonia samples to be measured were placed in a liquid helium cooled cryostat. The configuration for the thickness measurement is shown in Figure (3). The position of a target cell in relation to the lab table outside the cryostat was determined to better than 0.5 mm. The target was exposed to the ^{241}Am source for five minutes per scan point. One important difference of the target configuration used in the thickness measurement and in the electron beam runs is that the helium bath in the thickness measurement was at 4 K which is above the lambda point of helium (1.6 K), while that in the ESA runs was below the lambda point. In the ESA electron beam runs the helium density is approximately 13% greater than during the thickness measurement. Incorrectly applying the greater helium density of 0.145 grams per cubic cm would increase the denominator in equation (5) to 0.46847 for NH_3 and 0.46144 for ND_3,

resulting in a 1.8% increase in computed packing fraction. The packing fraction is a measurement of the physical dimmensions of the ammonia, irrespective of the surrounding helium. The packing fraction which we have measured is the value which should be used.

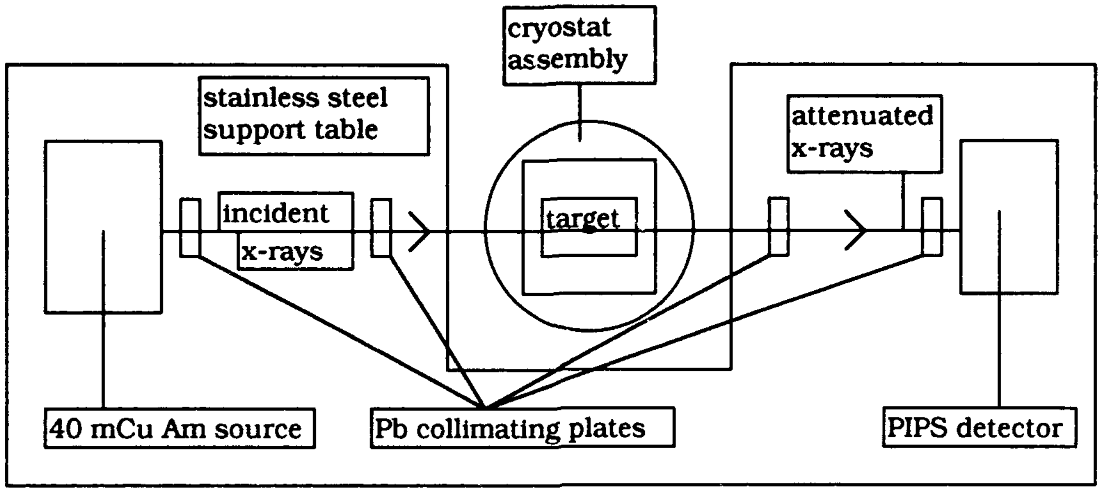

Figure 3. Thickness measurement schematic.

The source was set on one end of a rectangular steel support plate. A large notch was cut out of the side of the support plate in the center so that the tailpiece of the helium dewar could be set in. The support plate was mounted on a milling machine drive that allowed a Cartesian coordinate mapping of the target face by adjusting the support plate after each five minute scan point measurement. At several points along the beam path there are lead collimating plates with holes of five mm diameter. It is these holes that define the spots that overlap and cover the entire target face. The outermost one mm ring was not scanned by the electron beam in ESA and so was omitted from the thickness mapping. The face area of a target window is covered, with minimal overlap, by 21 scan points as shown in Figure (4).

Because of the presence of Cu/Ni wire coils for NMR measurements of the target polarization, the assignment of scan point centersmight have an inordinate influence on the target thickness measurement. To insure that this was not the case, new scan

point locations were assigned to point #'s 7, 9, 15 and 17. These new points are the "primed" point #'s 7', 9', 15', 17'. The primed scan points have the same horizontal coordinates as the unprimed points but are 0.03 inches closer to the center in the vertical direction. Stick #1 has no prime point measurements as it was done before this coverage effect was realized. As seen in Table #'s 6-15, the use of the original or the primed points results in very little difference in the final thickness results.

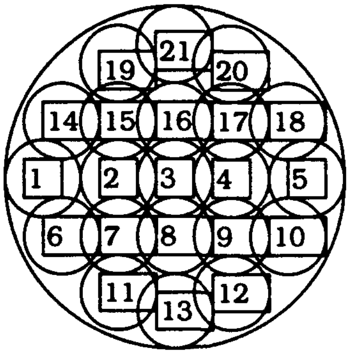

Figure 4. Pattern of 5 mm diameter scan points.

The detector was a Canberra Passivated Implanted Planar Silicon (PIPS) with associated FET input preamplifier (CNP89). The output signal was displayed with "Nucleus-II" personal computer analyzer software(OXT90). The distance from the ^{241}Am source to the detector was 28.5 cm.

2.3 Calculations and Tabulations

Our results were tabulated using "Excel" spreadsheet software (MSC93). There are seven data sets, each consisting of a top cell and a bottom cell entry. The data is divided as follows; The data set for stick #1, refers to the material radiated at Bates Lab at MIT. The data set for stick #2a is from early January 1994, that did not use the "prime" raster positions, refers to the material radiated at the Saskatchewan Accelerator Lab. The data set for stick #2b was taken later that month and did not use the primed scan points. The ND_3 for stick #2b was from Bates Lab but the NH_3 was the material radiated at the Naval Postgraduate School in Monterey. The data for stick

#2b' is identical to #2b except for using the values at the primed scan point locations. The data set for stick #3a is from early January, 1994, containing both ND_3 and NH_3 from NPS. The data set for stick #3b was taken in mid February, 1994 after final exposure in ESA. The material in stick #3b was all radiated at the Stanford High Energy Physics Lab 60 MeV linac. The data for stick #3b' is identical to #3b except for using the values at the primed scan point locations.

The columns of the data are arranged in tables as follows: "Scan Point" is the numbered position of the five mm diameter circle of the pattern of 21 used to cover the face of a target. The next two columns are grid coordinates of the relative positions of the scan points. The fourth column is the integrated intensity, including "background", of the "empty" target. Our assumption in including the "background" from the spectrum was that it was directional from the source due to our precautionary shielding of the detector and collimating of the beam. The fifth column is the same data for a corresponding "full" target, again including the background since we are subtracting logarithms and so must include the entire sum of intensities at the detector. The sixth column takes the logarithm of the ratio of the fourth to the fifth column. The "Mass-Thik" column performs equation (6) by dividing the sixth column by the given denominator to give a value for the mass thickness in grams per square centimeter. Column number eight gives a normalized value for the mass thickness by dividing each point by the average of the middle nine scan points (#'s 2, 3, 4, 7, 8, 9, 15, 16, 17). Column number nine gives the packing fraction corresponding to the thickness value in the seventh column by performing equation (5). The last column gives the fractional uncertainty in intensity.

The bottom two entries of column numbers four and five average the intensities above them over all 21 points, or only the center 9, while for the last five column calculations, the algebraic operation is performed on the averages derived in the bottom two entries of Column number six. The difference between the average of the

logarithms and the logarithm of the averages is negligible. This was determined by having the final values of column numbers six through ten calculated by averaging over the 21 points in the column above them rather than operating on the values un the row to their left. The numbers obtained either way differ by less than 0.2%.

3. CONCLUSION

3.1 Data presentation

The final results for the target thickness and packing fraction measurement are displayed, with their random errors, in Table (1) below.

Stick#	Sample	Cell Type	Thickness	RndmUnc	PacFract.	RndmUnc
1;	Bates	Top-NH3	1.79	0.009	0.651	0.003
	Bates	Bot-NH3	1.578	0.008	0.573	0.003
2a;	SAL	Top-ND3	1.82	0.01	0.575	0.003
	SAL	Bot-NH3	1.397	0.008	0.508	0.003
2b;	Bates	Top-ND3	1.85	0.01	0.583	0.003
	NPS	Bot-NH3	1.53	0.008	0.556	0.003
2b';	Bates	Top-ND3	1.84	0.01	0.58	0.003
	NPS	Bot-NH3	1.5	0.008	0.546	0.003
3a;	NPS	Top-ND3	1.643	0.009	0.519	0.003
	NPS	Bot-NH3	1.384	0.008	0.503	0.003
3b;	HEPL	Top-ND3	1.701	0.009	0.537	0.003
	HEPL	Bot-NH3	1.409	0.008	0.512	0.003
3b';	HEPL	Top-ND3	1.7	0.009	0.537	0.003
	HEPL	Bot-NH3	1.41	0.008	0.512	0.003

Table 1. Target thickness measurement results.

3.2 2-D Trend analysis

An important question about the experimental results is whether there was a settling effect and the average thickness decreases with height. Table #10 shows the data sets arranged by vertical elevation on the target face, averaged over horizontal scan points. It is seen that the effect of the primed scan points is minor and that the greatest difference due to using them over the unprimed points is of the order of 0.5%

for stick #3b and Stick #2b ND_3, and 2.0% for the NH_3 in stick #2b. In all four cases, the correction for primed scan points produced lower thickness values. Table #'s 11-15 show graphically the variation of target thickness as afunction of vertical position. The arrangement of the data sets into tables for display is shown in table (2).

Table #	Description
3	Stick #1 scan point value analysis
4	Stick #2a scan point value analysis
5	Stick #2b scan point value analysis
6	Stick #2b' scan point value analysis
7	Stick #3a scan point value analysis
8	Stick #3b scan point value analysis
9	Stick #3b' scan point value analysis
10	Vertical average values of all sticks
11	Stick #1 2-D variation with height
12	Stick #2a 2-D variation with height
13	Stick #2b' 2-D variation with height
14	Stick #3a 2-D variation with height
15	Stick #3b' 2-D variation with height

Table 2. Description of data display tables

The error bars shown are the range of the horizontal values at a given vertical height. Note that in Table #'s 11-15 the error range is larger for the central positions because there are more data points there and so the range of values spanned by the average is greater. All of the graphs appear to be consistent with thickness decreasing as height increases except stick #3b prime which appears relatively flat in comparison.

3.3 3-D Trend analysis

In order to visualize the non-uniformity of the target, Figure 5 shows the grid pattern of (unprimed) data points for for stick #1 bottom cell. Figure 6 presents a three dimensional view of the target thickness for the bottom cell of that stick, and Figure 7 is a contour plot of the same data. The primed scan points are shown in Figure 8. Figure #'s 9 and 10 are the three dimensional and contour view of the bottom cell of stick #3b prime and show a more uniform thickness which explains the relative flatness observed in table #14

3.4 Acknowledgments

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References

AIC93	AIC Software of Grafton Mass., 1993. Compiled from The National Bureau of Standards (Berger and Hubbell, 1987), Los Alamos National Laboratory (Storm and Israel, 1967) and the Kaman Sciences Corporation (Viegele et al., 1971).
CNP89	Technical specifications are in the Canberra Nuclear Products Group of Meriden CT product Catalog, 8th edition, 1989.
CRA90	D.G. Crabb, Physical Review Letters, Volume #64 (1990), pg. #2627.
LMS93	L.M. Stuart "E143 target specifications summary" memo of 11/4/93.
MCC93	J. McCarthy, et al, E143 Collaboration Proposal of 1993.
MCM67	McMaster et al., UCRL-50174-Sec.1-Rev.1, 1967.
MSC93	Version 4.0 by Microsoft Corporation of Redmond WA, 1993
OXT90	"Nucleus PCA-II", by Oxford/Tennelec of Oak Ridge TN, 1990.
PVM93	Physics Vad Mecum, 2nd Ed. , 1989, H.J. Anderson, Editor.
SHA93	Dr. J. Button-Shafer, Univ. of Mass., Amherst, designed and acquired the material for the measurement apparatus and was responsible for coordinating team member actions.
SIC93	Ingo Sick and Beni Zihlmann, E143 Tech Memo, 19 May, 1994.
TAY82	J. R. Taylor, "An Introduction to Error Analysis", 1982, Oxford.
WIL84	G. E. Chart of the Nuclides, 13th Ed., 1984, Williams, Editor.

Figure Captions

Figure 1.	E143 experiment schematic. Polarized electrons are scattered by a polarized ammonia target. Scattering asymmetry is measured.
Figure 2.	Target assembly in E143 experiment. Various components of the target are defined.
Figure 3.	Target thickness measurement schematic. 60 keV x-rays from a ^{241}Am source are attenuated through the ammonia target. The distance from the x-ray source to the detector is 28.5 cm.
Figure 4.	Pattern of scan points. Each small scan point circle is five mm in diameter. 21 of these circles covered the area over which the incident electron beam was scanned during the experiment.
Figure 5.	Center of scan points for the "unprimed" scan centers #'s1-21.
Figure 6.	Thickness variation for stick #1, bottom cell, Bates NH_3 target. The data is presented in Table #1.
Figure 7.	Thickness contour for target shown in Figure 6.
Figure 8.	Center of scan points for the "primed" scan centers #'s 1-6, 7', 8, 9', 10-14, 15', 16, 17', 18-21.
Figure 9.	Thickness variation for stick #3b prime, bottom cell, HEPL NH_3 target. The data is presented in Table #9.
Figure 10.	Thickness contour for target shown in Figure 9.

Column#:	2	3	4	5	6	7	8	9	10
Col.Units:	inches	inches	counts	counts	unitless	gr/cm^2	unitless	unitless	counts
ScanPoint	Horizontal	Vertical	Run #s	Run #s	Int. Ratio	Mass-Thik	Nrm-Thik	PackFract	"I"Uncert
Stick #1:	Top NH3	Bates	844-864	674-694	Ln(Ie/Iam)	(/)0.17335	(/)21ptAv	(/).47689	(SmInv)/d
1	-0.35	0	16570	12311	0.297101	1.713877	0.956815	0.622996	0.02183
2	-0.18	0	15533	11371	0.311901	1.799253	1.004479	0.65403	0.022099
3	0	0	14008	10420	0.295902	1.70696	0.952954	0.620482	0.023782
4	0.18	0	15207	11967	0.239603	1.382192	0.771644	0.502428	0.024964
5	0.35	0	15730	12141	0.258982	1.493981	0.834053	0.543064	0.023738
6	-0.3	-0.17	16575	10301	0.475655	2.743897	1.53185	0.997409	0.018192
7	-0.15	-0.17	15245	10430	0.379565	2.189589	1.222394	0.795918	0.020626
8	0	-0.17	14400	10333	0.331886	1.91454	1.06884	0.695937	0.022379
9	0.15	-0.17	15205	11001	0.323638	1.866964	1.04228	0.678643	0.022002
10	0.3	-0.17	14801	10286	0.363911	2.099285	1.171979	0.763092	0.021279
11	-0.25	-0.3	16264	9940	0.492387	2.840421	1.585737	1.032496	0.018144
12	0.17	-0.3	14288	11120	0.250675	1.446061	0.8073	0.525645	0.025258
13	0	-0.35	15037	9257	0.485134	2.79858	1.562378	1.017287	0.018967
14	-0.3	0.17	15736	12285	0.247572	1.428163	0.797308	0.519139	0.024197
15	-0.15	0.17	15017	10718	0.337258	1.945534	1.086144	0.707204	0.021774
16	0	0.17	13899	10269	0.302687	1.746105	0.974807	0.634711	0.023652
17	0.15	0.17	14651	11483	0.243641	1.405486	0.784648	0.510895	0.02525
18	0.3	0.17	13477	11416	0.165969	0.957419	0.534504	0.348023	0.031223
19	-0.25	0.26	15528	11782	0.276072	1.592569	0.889092	0.578901	0.023253
20	0.17	0.26	15657	12563	0.220162	1.270044	0.709034	0.461662	0.025527
21	0	0.31	15244	11776	0.258122	1.489025	0.831286	0.541262	0.024148
Cntr.9Avg	N/A	N/A	14796.11	10888	0.306703	1.769271	0.98774	0.643132	0.0076
21CellAvg	N/A	N/A	15146.29	11103.33	0.31051	1.791231	1	0.651114	0.004893
Stick #1:	Bot NH3	Bates	873-893	696-716	Ln(Ie/Iam)	(/)0.17335	(/)21ptAv	(/)0.47689	(SmInv)/d
1	-0.35	0	16535	12554	0.27544	1.588924	1.007168	0.577576	0.022556
2	-0.18	0	16035	11908	0.297563	1.716547	1.088064	0.623967	0.022176
3	0	0	16093	11516	0.334647	1.93047	1.223663	0.701728	0.021099
4	0.18	0	14832	10994	0.299437	1.727357	1.094916	0.627896	0.022998
5	0.35	0	15423	11910	0.258482	1.491096	0.945158	0.542015	0.023993
6	-0.3	-0.17	15637	11227	0.331318	1.911268	1.211491	0.694748	0.021491
7	-0.15	-0.17	15887	11377	0.333907	1.926204	1.220958	0.700177	0.021254
8	0	-0.17	15048	11163	0.29864	1.722759	1.092002	0.626225	0.022858
9	0.15	-0.17	14382	10637	0.301639	1.740057	1.102966	0.632513	0.023285
10	0.3	-0.17	14806	10807	0.314838	1.816201	1.151231	0.660191	0.022548
11	-0.25	-0.3	15114	10873	0.329339	1.899849	1.204253	0.690597	0.021913
12	0.17	-0.3	15940	11317	0.342526	1.97592	1.252472	0.718249	0.021003
13	0	-0.35	14290	10704	0.288942	1.666816	1.056541	0.605889	0.023781
14	-0.3	0.17	12707	10757	0.166596	0.96104	0.609172	0.349339	0.0321
15	-0.15	0.17	13969	11841	0.165273	0.953404	0.604332	0.346563	0.030727
16	0	0.17	15166	12147	0.221974	1.280495	0.811665	0.465461	0.025844
17	0.15	0.17	14260	11554	0.210427	1.213884	0.769442	0.441248	0.027287
18	0.3	0.17	13927	11286	0.210266	1.212959	0.768855	0.440912	0.02762
19	-0.25	0.26	14039	11932	0.162615	0.938075	0.594616	0.340991	0.030877
20	0.17	0.26	15290	11197	0.311553	1.797249	1.139218	0.653302	0.022284
21	0	0.31	15295	11681	0.269562	1.555018	0.985676	0.565251	0.023667
Cntr.9Avg	N/A	N/A	15074.67	11459.67	0.274182	1.581667	1.002568	0.574938	0.00789
21CellAvg	N/A	N/A	14984.52	11399.14	0.27348	1.577616	1	0.573465	0.005186

Column#:	2	3	4	5	6	7	8	9	10
Col.Units:	inches	inches	counts	counts	unitless	gr/cm^2	unitless	unitless	counts
ScanPoint	Horizontal	Vertical	Run #s	Run #s	Int. Ratio	Mass-Thik	Nrm-Thik	PackFract	"I"Uncert
Stick #2a	Top ND3	SAL	1121-114	593-613	Ln(Ie/Iam)	(/)0.14832	(/)21ptAv	(/)0.46988	(SmInv)/d
1	-0.35	0	15714	10434	0.409482	2.760803	1.514631	0.871462	0.019735
2	-0.18	0	12675	11083	0.134219	0.90493	0.496462	0.285646	0.035497
3	0	0	12810	10611	0.188335	1.269788	0.696631	0.400815	0.030247
4	0.18	0	13747	10326	0.286156	1.929313	1.058459	0.608997	0.024344
5	0.35	0	14501	10250	0.34694	2.339131	1.283294	0.738359	0.021908
6	-0.3	-0.17	15144	10381	0.377627	2.54603	1.396803	0.803667	0.020735
7	-0.15	-0.17	14556	9976	0.377821	2.547337	1.39752	0.80408	0.021146
8	0	-0.17	14309	10310	0.327774	2.209914	1.212402	0.69757	0.022564
9	0.15	-0.17	15302	10153	0.410214	2.765738	1.517339	0.873019	0.019985
10	0.3	-0.17	15024	10887	0.32208	2.171518	1.191338	0.685451	0.022178
11	-0.25	-0.3	14366	10628	0.301372	2.031906	1.114744	0.641381	0.023306
12	0.17	-0.3	14601	11052	0.278479	1.877553	1.030063	0.592659	0.023892
13	0	-0.35	13599	9883	0.31918	2.15197	1.180613	0.67928	0.023397
14	-0.3	0.17	13330	11715	0.129147	0.870733	0.477701	0.274851	0.03524
15	-0.15	0.17	13836	10970	0.23211	1.564925	0.858549	0.493976	0.026535
16	0	0.17	13309	11863	0.115016	0.77546	0.425433	0.244778	0.037231
17	0.15	0.17	14761	11390	0.259253	1.747929	0.958948	0.551743	0.024494
18	0.3	0.17	13833	11853	0.154476	1.041505	0.57139	0.328756	0.031845
19	-0.25	0.26	15175	11810	0.250703	1.690283	0.927322	0.533546	0.024507
20	0.17	0.26	14968	10982	0.309657	2.087763	1.145388	0.659013	0.022579
21	0	0.31	14560	12468	0.155113	1.045797	0.573745	0.330111	0.030982
Cntr9Avg	N/A	N/A	13922.78	10742.44	0.259324	1.748406	0.95921	0.551893	0.008406
21CellAvg	N/A	N/A	14291.43	10905.95	0.270351	1.822756	1	0.575362	0.005336
Stick #2a	Bot NH3	SAL	1095-111	570-590	Ln(Ie/Iam)	(/)0.17335	(/)21ptAv	(/)0.47689	(SmInv)/d
1	-0.35	0	13382	12064	0.103685	0.598124	0.428128	0.217419	0.038989
2	-0.18	0	15356	9919	0.437054	2.521224	1.804655	0.916467	0.019485
3	0	0	14434	10194	0.347787	2.006272	1.43606	0.729282	0.021938
4	0.18	0	14439	10763	0.293819	1.694944	1.213216	0.616114	0.023493
5	0.35	0	13127	11340	0.146335	0.844159	0.604236	0.306852	0.033514
6	-0.3	-0.17	13177	10977	0.182671	1.053768	0.754272	0.383046	0.030235
7	-0.15	-0.17	13541	10915	0.215584	1.243635	0.890176	0.452063	0.027704
8	0	-0.17	14206	10918	0.263252	1.518613	1.087001	0.552017	0.024806
9	0.15	-0.17	15022	11314	0.283475	1.635275	1.170506	0.594424	0.02338
10	0.3	-0.17	13932	11436	0.197422	1.138864	0.815182	0.413978	0.028399
11	-0.25	-0.3	13785	10781	0.245796	1.417916	1.014923	0.515414	0.025933
12	0.17	-0.3	14786	11107	0.286105	1.650448	1.181367	0.59994	0.023475
13	0	-0.35	15424	9746	0.459068	2.648213	1.895552	0.962628	0.019098
14	-0.3	0.17	13807	10714	0.253624	1.463077	1.047249	0.53183	0.025565
15	-0.15	0.17	15168	10980	0.323113	1.863931	1.334175	0.677541	0.022043
16	0	0.17	13839	10622	0.264563	1.52618	1.092417	0.554768	0.025079
17	0.15	0.17	13322	11755	0.125138	0.721881	0.516712	0.262405	0.035772
18	0.3	0.17	13870	11187	0.214976	1.240126	0.887664	0.450787	0.027408
19	-0.25	0.26	12345	12552	-0.01663	-0.09593	-0.06866	-0.03487	#NUM!
20	0.17	0.26	15357	11955	0.250422	1.444602	1.034025	0.525114	0.024373
21	0	0.31	14427	11681	0.211138	1.217986	0.871816	0.442739	0.027088
Cntr.9Avg	N/A	N/A	14369.67	10820	0.283723	1.636707	1.171531	0.594945	0.007965
21CellAvg	N/A	N/A	14130.76	11091.43	0.242182	1.397067	1	0.507835	0.005625

Column#:	2	3	4	5	6	7	8	9	10
Col.Units:	inches	inches	counts	counts	unitless	gr/cm^2	unitless	unitless	counts
ScanPoint	Horizontal	Vertical	Run #s	Run #s	Int. Ratio	Mass-Thik	Nrm-Thik	PackFract	"I"Uncert
Stick #2b	Top ND3	Bates	1121-114	762-782	Ln(Ie/Iam)	(/)0.14832	(/)21ptAv	(/)0.46988	(SmInv)/d
1	-0.35	0	15714	11983	0.271063	1.827556	0.98998	0.576877	0.023295
2	-0.18	0	12675	10319	0.205645	1.386493	0.751058	0.437654	0.029239
3	0	0	12810	10277	0.220318	1.485422	0.804647	0.468881	0.028213
4	0.18	0	13747	10609	0.259118	1.747019	0.946354	0.551456	0.025387
5	0.35	0	14501	11200	0.258304	1.741531	0.943381	0.549723	0.024752
6	-0.3	-0.17	15144	10403	0.37551	2.531757	1.371443	0.799162	0.020781
7	-0.15	-0.17	14556	10767	0.301517	2.032884	1.101206	0.64169	0.023149
8	0	-0.17	14309	10600	0.300035	2.022888	1.095791	0.638535	0.023396
9	0.15	-0.17	15302	10810	0.347512	2.342988	1.269188	0.739576	0.021313
10	0.3	-0.17	15024	10393	0.368516	2.484604	1.345901	0.784278	0.021017
11	-0.25	-0.3	14366	10636	0.30062	2.026833	1.097928	0.63978	0.02333
12	0.17	-0.3	14601	10840	0.297847	2.008138	1.087801	0.633879	0.023231
13	0	-0.35	13599	9437	0.365358	2.46331	1.334366	0.777556	0.022165
14	-0.3	0.17	13330	10149	0.272642	1.838201	0.995747	0.580237	0.02523
15	-0.15	0.17	13836	10691	0.257872	1.738617	0.941802	0.548803	0.025357
16	0	0.17	13309	10487	0.238304	1.606689	0.870337	0.507159	0.026748
17	0.15	0.17	14761	11663	0.235567	1.588236	0.860341	0.501335	0.025526
18	0.3	0.17	13833	11033	0.226166	1.524853	0.826007	0.481328	0.02684
19	-0.25	0.26	15175	12160	0.221497	1.493376	0.808956	0.471392	0.025861
20	0.17	0.26	14968	11779	0.239596	1.615401	0.875057	0.50991	0.025163
21	0	0.31	14560	11999	0.193455	1.304306	0.706538	0.411711	0.028033
Cntr9Avg	N/A	N/A	13922.78	10691.44	0.264082	1.780491	0.964485	0.562021	0.008341
21CellAvg	N/A	N/A	14291.43	10868.33	0.273807	1.846053	1	0.582716	0.005308
Stick #2b	Bot NH3	NPS	1095-111	789-809	Ln(Ie/Iam)	(/)0.17335	(/)21ptAv	(/)0.47689	(SmInv)/d
1	-0.35	0	13382	10198	0.271719	1.567458	1.024704	0.569773	0.025217
2	-0.18	0	15356	11018	0.331976	1.915062	1.251944	0.696127	0.021669
3	0	0	14434	10515	0.316784	1.827423	1.194652	0.66427	0.02278
4	0.18	0	14439	10084	0.358983	2.070856	1.353793	0.752758	0.02166
5	0.35	0	13127	10254	0.247003	1.424882	0.931496	0.517946	0.026519
6	-0.3	-0.17	13177	10149	0.261098	1.506188	0.984649	0.547501	0.025846
7	-0.15	-0.17	13541	10186	0.284708	1.642388	1.073688	0.59701	0.024581
8	0	-0.17	14206	9959	0.355188	2.048963	1.33948	0.7448	0.021929
9	0.15	-0.17	15022	10020	0.404933	2.335926	1.527078	0.849111	0.02027
10	0.3	-0.17	13932	10635	0.270038	1.557761	1.018364	0.566248	0.024779
11	-0.25	-0.3	13785	10441	0.277841	1.602773	1.04779	0.58261	0.024613
12	0.17	-0.3	14786	10988	0.296877	1.712587	1.11958	0.622527	0.023116
13	0	-0.35	15424	9723	0.461431	2.661843	1.740142	0.967583	0.019063
14	-0.3	0.17	13807	11823	0.155129	0.894889	0.585021	0.325293	0.031814
15	-0.15	0.17	15168	11229	0.300688	1.734573	1.133952	0.630519	0.022703
16	0	0.17	13839	11010	0.228687	1.31922	0.862421	0.479538	0.026705
17	0.15	0.17	13322	12387	0.072769	0.419782	0.274427	0.152591	0.04627
18	0.3	0.17	13870	11724	0.16809	0.969658	0.6339	0.352472	0.0306
19	-0.25	0.26	12345	12020	0.026679	0.153904	0.100612	0.055944	0.078451
20	0.17	0.26	15357	10585	0.372133	2.146718	1.403386	0.780334	0.020709
21	0	0.31	14427	12679	0.129154	0.74505	0.487066	0.270826	0.033873
Cntr.9Avg	N/A	N/A	14369.67	10712	0.293755	1.694577	1.107805	0.61598	0.007851
21CellAvg	N/A	N/A	14130.76	10839.38	0.265168	1.52967	1	0.556036	0.005411

Column#:	2	3	4	5	6	7	8	9	10
Col.Units:	inches	inches	counts	counts	unitless	gr/cm^2	unitless	unitless	counts
ScanPoint	Horizontal	Vertical	Run #s	Run #s	Int. Ratio	Mass-Thik	Nrm-Thik	PackFract	"I"Uncert
Stick #2b'	Top ND3	Bates	1121-114	762-786	Ln(Ie/Iam)	(/)0.14832	(/)21ptAv	(/)0.46988	(SmInv)/d
1	-0.35	0	15714	11983	0.271063	1.827556	0.995357	0.576877	0.023295
2	-0.18	0	12675	10319	0.205645	1.386493	0.755138	0.437654	0.029239
3	0	0	12810	10277	0.220318	1.485422	0.809018	0.468881	0.028213
4	0.18	0	13747	10609	0.259118	1.747019	0.951494	0.551456	0.025387
5	0.35	0	14501	11200	0.258304	1.741531	0.948505	0.549723	0.024752
6	-0.3	-0.17	15144	10403	0.37551	2.531757	1.378892	0.799162	0.020781
7'	-0.15	-0.14	15024	10839	0.326498	2.201309	1.198918	0.694854	0.022055
8	0	-0.17	14309	10600	0.300035	2.022888	1.101743	0.638535	0.023396
9'	0.15	-0.14	15577	11440	0.308679	2.081172	1.133487	0.656933	0.022162
10	0.3	-0.17	15024	10393	0.368516	2.484604	1.353211	0.784278	0.021017
11	-0.25	-0.3	14366	10636	0.30062	2.026833	1.103891	0.63978	0.02333
12	0.17	-0.3	14601	10840	0.297847	2.008138	1.093709	0.633879	0.023231
13	0	-0.35	13599	9437	0.365358	2.46331	1.341614	0.777556	0.022165
14	-0.3	0.17	13330	10149	0.272642	1.838201	1.001155	0.580237	0.02523
15'	-0.15	0.14	13531	10958	0.210914	1.422017	0.774485	0.448867	0.027984
16	0	0.17	13309	10487	0.238304	1.606689	0.875065	0.507159	0.026748
17'	0.15	0.14	14658	11287	0.261335	1.761965	0.959634	0.556173	0.024496
18	0.3	0.17	13833	11033	0.226166	1.524853	0.830494	0.481328	0.02684
19	-0.25	0.26	15175	12160	0.221497	1.493376	0.81335	0.471392	0.025861
20	0.17	0.26	14968	11779	0.239596	1.615401	0.87981	0.50991	0.025163
21	0	0.31	14560	11999	0.193455	1.304306	0.710376	0.411711	0.028033
Cntr9Avg	N/A	N/A	13960	10757.33	0.260608	1.757069	0.956967	0.554628	0.008377
21CellAvg	N/A	N/A	14307.38	10896.57	0.272327	1.83608	1	0.579568	0.005317
Stick #2b'	Bot NH3	NPS	1095-111	789-813	Ln(Ie/Iam)	(/)0.17335	(/)21ptAv	(/)0.47689	(SmInv)/d
1	-0.35	0	13382	10198	0.271719	1.567458	1.044297	0.569773	0.025217
2	-0.18	0	15356	11018	0.331976	1.915062	1.275883	0.696127	0.021669
3	0	0	14434	10515	0.316784	1.827423	1.217494	0.66427	0.02278
4	0.18	0	14439	10084	0.358983	2.070856	1.379678	0.752758	0.02166
5	0.35	0	13127	10254	0.247003	1.424882	0.949307	0.517946	0.026519
6	-0.3	-0.17	13177	10149	0.261098	1.506188	1.003476	0.547501	0.025846
7'	-0.15	-0.14	13307	10295	0.256632	1.480426	0.986313	0.538136	0.02591
8	0	-0.17	14206	9959	0.355188	2.048963	1.365093	0.7448	0.021929
9'	0.15	-0.14	14177	10151	0.334049	1.927019	1.283849	0.700473	0.022496
10	0.3	-0.17	13932	10635	0.270038	1.557761	1.037836	0.566248	0.024779
11	-0.25	-0.3	13785	10441	0.277841	1.602773	1.067825	0.58261	0.024613
12	0.17	-0.3	14786	10988	0.296877	1.712587	1.140987	0.622527	0.023116
13	0	-0.35	15424	9723	0.461431	2.661843	1.773415	0.967583	0.019063
14	-0.3	0.17	13807	11823	0.155129	0.894889	0.596207	0.325293	0.031814
15'	-0.15	0.14	14512	11295	0.250616	1.445721	0.963191	0.525521	0.025064
16	0	0.17	13839	11010	0.228687	1.31922	0.878911	0.479538	0.026705
17'	0.15	0.14	13561	12063	0.117055	0.675253	0.449878	0.245455	0.036581
18	0.3	0.17	13870	11724	0.16809	0.969658	0.646021	0.352472	0.0306
19	-0.25	0.26	12345	12020	0.026679	0.153904	0.102536	0.055944	0.078451
20	0.17	0.26	15357	10585	0.372133	2.146718	1.43022	0.780334	0.020709
21	0	0.31	14427	12679	0.129154	0.74505	0.496379	0.270826	0.033873
Cntr.9Avg	N/A	N/A	14203.44	10710	0.282307	1.628535	1.084989	0.591974	0.008029
21CellAvg	N/A	N/A	14059.52	10838.52	0.260193	1.50097	1	0.545604	0.005468

Column#:	2	3	4	5	6	7	8	9	10
Col.Units:	inches	inches	counts	counts	unitless	gr/cm^2	unitless	unitless	counts
ScanPoint	Horizontal	Vertical	Run #s	Run #s	Int. Ratio	Mass-Thik	Nrm-Thik	PackFract	"!"Uncert
Stick #3a	Top ND3	NPS	994-1014	472-492	Ln(Ie/Iam)	(/)0.14832	(/)21ptAv	(/)0.46988	(SmInv)/d
1	-0.35	0	16027	12308	0.264025	1.780106	1.083206	0.5619	0.023325
2	-0.18	0	15958	10149	0.452585	3.05141	1.856802	0.963193	0.018872
3	0	0	15380	10510	0.380741	2.567023	1.56205	0.810294	0.02051
4	0.18	0	15923	11090	0.361721	2.438786	1.484017	0.769815	0.020565
5	0.35	0	15349	11385	0.298754	2.01425	1.225684	0.635808	0.022629
6	-0.3	-0.17	14715	12604	0.154853	1.044048	0.63531	0.329559	0.030842
7	-0.15	-0.17	13762	12511	0.095303	0.642549	0.390995	0.202824	0.040014
8	0	-0.17	13434	11336	0.169805	1.144858	0.696653	0.36138	0.03095
9	0.15	-0.17	14069	11418	0.208783	1.407651	0.856564	0.444332	0.027567
10	0.3	-0.17	13775	10737	0.24916	1.679879	1.022217	0.530262	0.025791
11	-0.25	-0.3	16142	10250	0.454147	3.061939	1.86321	0.966517	0.018741
12	0.17	-0.3	14385	11860	0.193015	1.301339	0.791873	0.410774	0.028231
13	0	-0.35	13103	11699	0.113338	0.764144	0.464987	0.241206	0.037783
14	-0.3	0.17	14077	12591	0.11156	0.752157	0.457693	0.237422	0.036724
15	-0.15	0.17	14078	12420	0.125305	0.84483	0.514085	0.266675	0.034777
16	0	0.17	14189	11802	0.184198	1.241896	0.755702	0.392011	0.029028
17	0.15	0.17	14334	11679	0.204842	1.381081	0.840397	0.435945	0.027542
18	0.3	0.17	14159	11194	0.234973	1.584227	0.964012	0.500069	0.026091
19	-0.25	0.26	13940	10736	0.26116	1.760786	1.07145	0.555801	0.025126
20	0.17	0.26	15285	11327	0.299683	2.020514	1.229496	0.637786	0.022647
21	0	0.31	15578	11505	0.303078	2.043406	1.243426	0.645011	0.022329
Cntr.9Avg	N/A	N/A	14569.67	11435	0.242263	1.63338	0.993922	0.515585	0.008461
21CellAvg	N/A	N/A	14650.57	11481.48	0.243744	1.643368	1	0.518737	0.005509
Stick #3a	Bot NH3	NPS	1045-106	494-514	Ln(Ie/Iam)	(/)0.17335	(/)21ptAv	(/)0.47689	(SmInv)/d
1	-0.35	0	13047	10379	0.228774	1.319721	0.953402	0.47972	0.027499
2	-0.18	0	14011	11506	0.196974	1.13628	0.820879	0.413039	0.028347
3	0	0	13409	11106	0.188441	1.087053	0.785316	0.395145	0.029556
4	0.18	0	15260	11415	0.290307	1.674686	1.209838	0.60875	0.022967
5	0.35	0	14400	11776	0.201165	1.160454	0.838343	0.421826	0.027701
6	-0.3	-0.17	14587	12194	0.179187	1.03367	0.746751	0.37574	0.028987
7	-0.15	-0.17	14891	12200	0.199321	1.149819	0.83066	0.41796	0.027352
8	0	-0.17	13578	11448	0.170636	0.984343	0.711116	0.35781	0.030717
9	0.15	-0.17	1361[illegible]	12242	0.106299	0.613207	0.442997	0.222901	0.038202
10	0.3	-0.17	14541	11221	0.259185	1.495156	1.080141	0.543491	0.024682
11	-0.25	-0.3	15658	10666	0.383921	2.214715	1.59997	0.805051	0.020262
12	0.17	-0.3	15055	11756	0.247346	1.426861	1.030803	0.518666	0.024748
13	0	-0.35	13879	11364	0.199926	1.153311	0.833183	0.41923	0.028294
14	-0.3	0.17	15660	10788	0.372675	2.149843	1.553105	0.78147	0.020496
15	-0.15	0.17	15570	11140	0.334804	1.931374	1.395277	0.702057	0.021446
16	0	0.17	15007	10302	0.376179	2.170053	1.567705	0.788817	0.020861
17	0.15	0.17	16128	11073	0.376047	2.169294	1.567157	0.788541	0.020126
18	0.3	0.17	14066	11655	0.188025	1.084657	0.783585	0.394274	0.028886
19	-0.25	0.26	13975	12540	0.108346	0.625016	0.451528	0.227194	0.037369
20	0.17	0.26	13976	11739	0.174425	1.006201	0.726907	0.365755	0.029977
21	0	0.31	14679	11416	0.251402	1.450257	1.047705	0.52717	0.024888
Cntr.9Avg	N/A	N/A	14607.67	11381.33	0.249572	1.4397	1.040078	0.523332	0.008342
21CellAvg	N/A	N/A	14523.43	11425.05	0.239955	1.384223	1	0.503166	0.005571

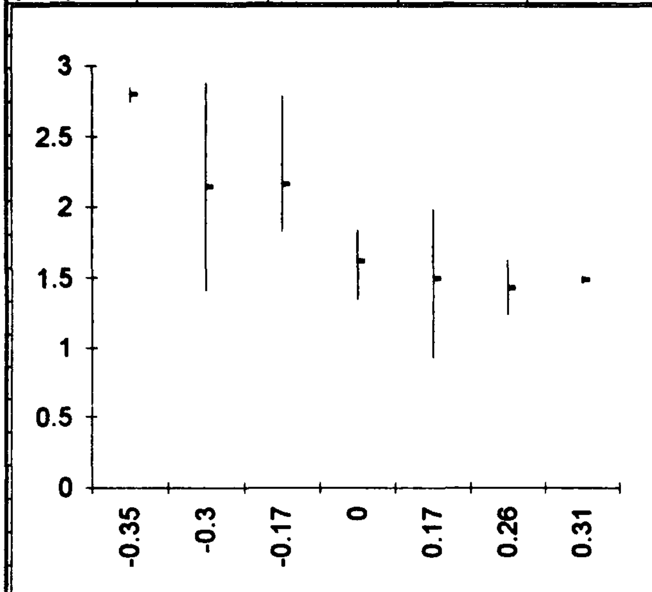
Column#:	2	3	4	5	6	7	8	9	10
Col.Units:	inches	inches	counts	counts	unitless	gr/cm^2	unitless	unitless	counts
ScanPoint	Horizontal	Vertical	Run #s	Run #s	Int. Ratio	Mass-Thik	Nrm-Thik	PackFract	"I"Uncert
Stick #3b	Top ND3	HEPL	994-1014	902-922	Ln(Ie/Iam)	(/)0.14832	(/)21ptAv	(/)0.46988	(SmInv)/d
1	-0.35	0	16027	12099	0.281152	1.895577	1.114246	0.598349	0.022713
2	-0.18	0	15958	12092	0.277416	1.87039	1.099441	0.590398	0.022891
3	0	0	15380	11576	0.284134	1.915682	1.126064	0.604695	0.023084
4	0.18	0	15923	12137	0.271506	1.830542	1.076018	0.57782	0.023125
5	0.35	0	15349	11830	0.260412	1.755742	1.032049	0.554209	0.023975
6	-0.3	-0.17	14715	10987	0.292155	1.969759	1.157851	0.621764	0.023327
7	-0.15	-0.17	13762	10477	0.272729	1.838786	1.080864	0.580422	0.024827
8	0	-0.17	13434	10326	0.263124	1.774028	1.042798	0.559981	0.025514
9	0.15	-0.17	14069	10759	0.268231	1.808463	1.063039	0.57085	0.024729
10	0.3	-0.17	13775	10245	0.296066	1.996127	1.173351	0.630088	0.023977
11	-0.25	-0.3	16142	10864	0.39597	2.669701	1.569287	0.842705	0.019721
12	0.17	-0.3	14385	10142	0.349501	2.356397	1.385123	0.743809	0.021932
13	0	-0.35	13103	9808	0.289643	1.952824	1.147897	0.616419	0.024809
14	-0.3	0.17	14077	11134	0.234539	1.581302	0.929511	0.499146	0.026188
15	-0.15	0.17	14078	10860	0.259527	1.749777	1.028543	0.552326	0.02507
16	0	0.17	14189	11488	0.211164	1.423706	0.836874	0.4494	0.027313
17	0.15	0.17	14334	11493	0.220896	1.489322	0.875444	0.470112	0.026641
18	0.3	0.17	14159	11576	0.201416	1.357986	0.798243	0.428655	0.02792
19	-0.25	0.26	13940	12454	0.112721	0.759982	0.446728	0.239892	0.036725
20	0.17	0.26	15285	13217	0.145368	0.980098	0.576115	0.309373	0.031153
21	0	0.31	15578	13487	0.144133	0.971773	0.571222	0.306745	0.030981
Cntr.9Avg	N/A	N/A	14569.67	11245.33	0.258989	1.746147	1.026409	0.55118	0.008222
21CellAvg	N/A	N/A	14650.57	11383.38	0.252325	1.701219	1	0.536999	0.005428
Stick #3b	Bot NH3	HEPL	1045-106	935-955	Ln(Ie/Iam)	(/)0.17335	(/21pt.Avg	(/)0.47689	(SmInv)/d
1	-0.35	0	13047	10309	0.235541	1.358759	0.964051	0.49391	0.027152
2	-0.18	0	14011	10715	0.268198	1.547148	1.097714	0.56239	0.024781
3	0	0	13409	10806	0.215825	1.245022	0.883353	0.452567	0.027827
4	0.18	0	15260	11726	0.263426	1.519622	1.078184	0.552384	0.023927
5	0.35	0	14400	10837	0.284262	1.639815	1.163462	0.596075	0.023852
6	-0.3	-0.17	14587	11381	0.248185	1.431701	1.015804	0.520425	0.025105
7	-0.15	-0.17	14891	11371	0.269691	1.555759	1.103823	0.56552	0.023981
8	0	-0.17	13578	10536	0.253653	1.463241	1.038182	0.53189	0.025779
9	0.15	-0.17	13615	10828	0.229037	1.321239	0.93743	0.480272	0.026906
10	0.3	-0.17	14541	10931	0.285369	1.646204	1.167995	0.598397	0.023697
11	-0.25	-0.3	15658	11781	0.284494	1.641153	1.164412	0.596561	0.022866
12	0.17	-0.3	15055	11808	0.242933	1.401401	0.994306	0.509411	0.024941
13	0	-0.35	13879	10343	0.294067	1.696377	1.203593	0.616635	0.023954
14	-0.3	0.17	15660	12267	0.244197	1.408693	0.999479	0.512061	0.024399
15	-0.15	0.17	15570	12148	0.248181	1.431678	1.015788	0.520417	0.0243
16	0	0.17	15007	11704	0.248586	1.434013	1.017444	0.521265	0.024734
17	0.15	0.17	16128	12590	0.247654	1.428636	1.013629	0.519311	0.023897
18	0.3	0.17	14066	11304	0.218604	1.261055	0.894729	0.458395	0.027017
19	-0.25	0.26	13975	11610	0.185403	1.069531	0.758841	0.388776	0.029164
20	0.17	0.26	13976	11338	0.209182	1.206701	0.856164	0.438637	0.027635
21	0	0.31	14679	12547	0.156936	0.905315	0.642328	0.329083	0.030691
Cntr.9Avg	N/A	N/A	14607.67	11380.44	0.24965	1.44015	1.021798	0.523496	0.008341
21CellAvg	N/A	N/A	14523.43	11375.24	0.244324	1.409427	1	0.512328	0.005528

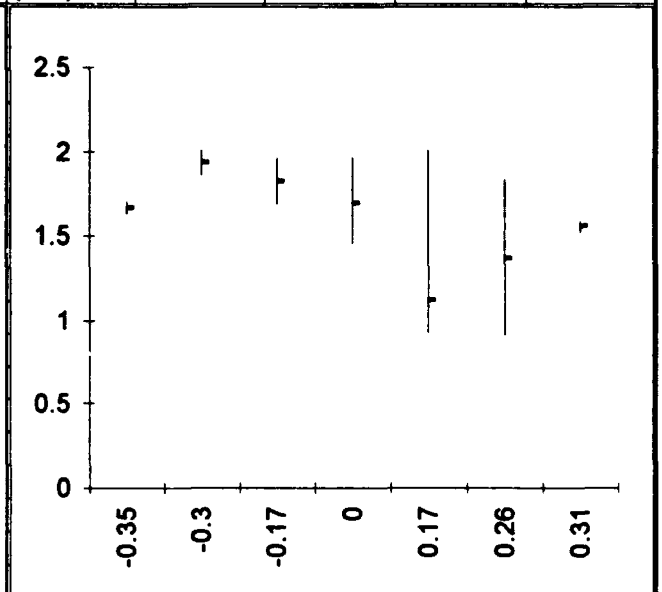
Column#:	2	3	4	5	6	7	8	9	10
Col.Units:	inches	inches	counts	counts	unitless	gr/cm^2	unitless	unitless	counts
ScanPoint	Horizontal	Vertical	Run #s	Run #s	Int. Ratio	Mass-Thik	Nrm-Thik	PackFract	"I"Uncert
Stick #3b'	Top ND3	HEPL	994-1018	902-926	Ln(Ie/Iam)	(/)0.14832	(/)21ptAv	(/)0.46988	(SmInv)/d
1	-0.35	0	16027	12099	0.281152	1.895577	1.114942	0.598349	0.022713
2	-0.18	0	15958	12092	0.277416	1.87039	1.100127	0.590398	0.022891
3	0	0	15380	11576	0.284134	1.915682	1.126767	0.604695	0.023084
4	0.18	0	15923	12137	0.271506	1.830542	1.076689	0.57782	0.023125
5	0.35	0	15349	11830	0.260412	1.755742	1.032693	0.554209	0.023975
6	-0.3	-0.17	14715	10987	0.292155	1.969759	1.158574	0.621764	0.023327
7'	-0.15	-0.14	13076	10001	0.268093	1.807534	1.063156	0.570557	0.025656
8	0	-0.17	13434	10326	0.263124	1.774028	1.043449	0.559981	0.025514
9'	0.15	-0.14	13778	10432	0.278195	1.875641	1.103216	0.592056	0.024606
10	0.3	-0.17	13775	10245	0.296066	1.996127	1.174083	0.630088	0.023977
11	-0.25	-0.3	16142	10864	0.39597	2.669701	1.570266	0.842705	0.019721
12	0.17	-0.3	14385	10142	0.349501	2.356397	1.385987	0.743809	0.021932
13	0	-0.35	13103	9808	0.289643	1.952824	1.148613	0.616419	0.024809
14	-0.3	0.17	14077	11134	0.234539	1.581302	0.930091	0.499146	0.026188
15'	-0.15	0.14	13572	10556	0.251314	1.694407	0.996617	0.534848	0.025887
16	0	0.17	14189	11488	0.211164	1.423706	0.837396	0.4494	0.027313
17'	0.15	0.14	14254	11423	0.221409	1.492777	0.878023	0.471203	0.026688
18	0.3	0.17	14159	11576	0.201416	1.357986	0.798741	0.428655	0.02792
19	-0.25	0.26	13940	12454	0.112721	0.759982	0.447007	0.239892	0.036725
20	0.17	0.26	15285	13217	0.145368	0.980098	0.576474	0.309373	0.031153
21	0	0.31	15578	13487	0.144133	0.971773	0.571578	0.306745	0.030981
Cntr.9Avg	N/A	N/A	14396	11114.56	0.258695	1.744167	1.025885	0.550555	0.008275
21CellAvg	N/A	N/A	14576.14	11327.33	0.252167	1.700158	1	0.536664	0.005443
Stick #3b'	Bot NH3	HEPL	1045-106	935-955	Ln(Ie/Iam)	(/)0.17335	(/)21ptAv	(/)0.47689	(SmInv)/d
1	-0.35	0	13047	10309	0.235541	1.358759	0.963831	0.49391	0.027152
2	-0.18	0	14011	10715	0.268198	1.547148	1.097464	0.56239	0.024781
3	0	0	13409	10806	0.215825	1.245022	0.883152	0.452567	0.027827
4	0.18	0	15260	11726	0.263426	1.519622	1.077939	0.552384	0.023927
5	0.35	0	14400	10837	0.284262	1.639815	1.163198	0.596075	0.023852
6	-0.3	-0.17	14587	11381	0.248185	1.431701	1.015573	0.520425	0.025105
7'	-0.15	-0.14	14995	11597	0.25697	1.482379	1.05152	0.538846	0.024394
8	0	-0.17	13578	10536	0.253653	1.463241	1.037945	0.53189	0.025779
9'	0.15	-0.14	13983	10738	0.264053	1.523239	1.080504	0.553699	0.02497
10	0.3	-0.17	14541	10931	0.285369	1.646204	1.167729	0.598397	0.023697
11	-0.25	-0.3	15658	11781	0.284494	1.641153	1.164146	0.596561	0.022866
12	0.17	-0.3	15055	11808	0.242933	1.401401	0.994079	0.509411	0.024941
13	0	-0.35	13879	10343	0.294067	1.696377	1.203319	0.616635	0.023954
14	-0.3	0.17	15660	12267	0.244197	1.408693	0.999252	0.512061	0.024399
15'	-0.15	0.14	15841	12207	0.260592	1.503271	1.06634	0.54644	0.023593
16	0	0.17	15007	11704	0.248586	1.434013	1.017212	0.521265	0.024734
17'	0.15	0.14	15379	12377	0.217163	1.252743	0.888629	0.455373	0.025913
18	0.3	0.17	14066	11304	0.218604	1.261055	0.894525	0.458395	0.027017
19	-0.25	0.26	13975	11610	0.185403	1.069531	0.758668	0.388776	0.029164
20	0.17	0.26	13976	11338	0.209182	1.206701	0.855969	0.438637	0.027635
21	0	0.31	14679	12547	0.156936	0.905315	0.642182	0.329083	0.030691
Cntr.9Avg	N/A	N/A	14607	11378.44	0.24978	1.440901	1.022098	0.523769	0.00834
21CellAvg	N/A	N/A	14523.14	11374.38	0.24438	1.409748	1	0.512445	0.005527

Stick#	Cell Type	y-coord	Avg.Thick	PacFract.	Stick#	Cell Type	y-coord	Avg.Thick	PacFract.
1,	Top-NH3	0.31	1.489	0.541258	1,	Bot-NH3	0.31	1.555	0.565249
Radiated	at:	0.26	1.431	0.520174	Radiated	at:	0.26	1.368	0.497274
Bates Lab	(MIT)	0.17	1.497	0.544166	Bates Lab	(MIT)	0.17	1.124	0.408579
		0	1.619	0.588513			0	1.691	0.614686
		-0.17	2.163	0.78626			-0.17	1.823	0.662668
		-0.3	2.143	0.778989			-0.3	1.938	0.704471
		-0.35	2.799	1.017448			-0.35	1.667	0.605961
2a	Top-ND3	0.31	1.046	0.330177	2a	Bot-NH3	0.31	1.218	0.442748
Radiated	at:	0.26	1.889	0.596275	Radiated	at:	0.26	0.6743	0.245111
SAL	(Canada)	0.17	1.2	0.378788	SAL	(Canada)	0.17	1.363	0.495456
		0	1.841	0.581124			0	1.533	0.557252
		-0.17	2.448	0.772727			-0.17	1.318	0.479099
		-0.3	1.955	0.617109			-0.3	1.534	0.557615
		-0.35	2.152	0.679293			-0.35	2.648	0.962559
2b	Top-ND3	0.31	1.304	0.411616	2b	Bot-NH3	0.31	0.7451	0.270847
Radiated	at:	0.26	1.554	0.49053	Radiated	at:	0.26	1.15	0.41803
Bates Lab	(MIT)	0.17	1.659	0.523674	NPS	(Monterey	0.17	1.068	0.388222
		0	1.638	0.517045			0	1.761	0.640131
		-0.17	2.283	0.720644			-0.17	1.818	0.660851
		-0.3	2.018	0.636995			-0.3	1.658	0.60269
		-0.35	2.463	0.777462			-0.35	2.662	0.967648
2b'	Top-ND3	0.31	1.304	0.411616	2b'	Bot-NH3	0.31	0.7451	0.270847
Radiated	at:	0.26	1.554	0.49053	Radiated	at:	0.26	1.15	0.41803
Bates Lab	(MIT)	0.14	1.631	0.514836	NPS	(Monterey	0.14	1.061	0.385678
		0	1.638	0.517045			0	1.761	0.640131
		-0.14	2.264	0.714646			-0.14	1.704	0.619411
		-0.3	2.018	0.636995			-0.3	1.658	0.60269
		-0.35	2.463	0.777462			-0.35	2.662	0.967648
3a;	Top-ND3	0.31	2.043	0.644886	3a;	Bot-NH3	0.31	1.45	0.527081
Radiated	at:	0.26	1.891	0.596907	Radiated	at:	0.26	0.8156	0.296474
NPS	(Monterey	0.17	1.161	0.366477	NPS	(Monterey	0.17	1.901	0.691021
		0	2.37	0.748106			0	1.276	0.463831
		-0.17	1.184	0.373737			-0.17	1.055	0.383497
		-0.3	2.182	0.688763			-0.3	1.821	0.661941
		-0.35	0.7641	0.241193			-0.35	1.153	0.41912
3b;	Top-ND3	0.31	0.9718	0.306755	3b;	Bot-NH3	0.31	0.9053	0.32908
Radiated	at:	0.26	0.87	0.274621	Radiated	at:	0.26	1.138	0.413668
HEPL	(Stanford)	0.17	1.52	0.479798	HEPL	(Stanford)	0.17	1.393	0.506361
		0	1.854	0.585227			0	1.462	0.531443
		-0.17	1.877	0.592487			-0.17	1.484	0.53944
		-0.3	2.513	0.793245			-0.3	1.521	0.55289
		-0.35	1.953	0.616477			-0.35	1.696	0.616503
3b';	Top-ND3	0.31	0.9718	0.306755	3b';	Bot-NH3	0.31	0.9053	0.32908
Radiated	at:	0.26	0.87	0.274621	Radiated	at:	0.26	1.138	0.413668
HEPL	(Stanford)	0.14	1.51	0.476641	HEPL	(Stanford)	0.14	1.372	0.498728
		0	1.854	0.585227			0	1.462	0.531443
		-0.14	1.885	0.595013			-0.14	1.509	0.548528
		-0.3	2.513	0.793245			-0.3	1.521	0.55289
		-0.35	1.953	0.616477			-0.35	1.696	0.616503

Stick#1	-0.35	2.852181	2.745819	2.799
Top Cell	-0.3	2.891404	1.409517	2.143
15NH3	-0.17	2.793941	1.827233	2.163
Radiated	0	1.838758	1.347645	1.619
at	0.17	1.988423	0.927548	1.497
Bates Lab	0.26	1.630117	1.237615	1.431
(MIT)	0.31	1.517291	1.460709	1.489

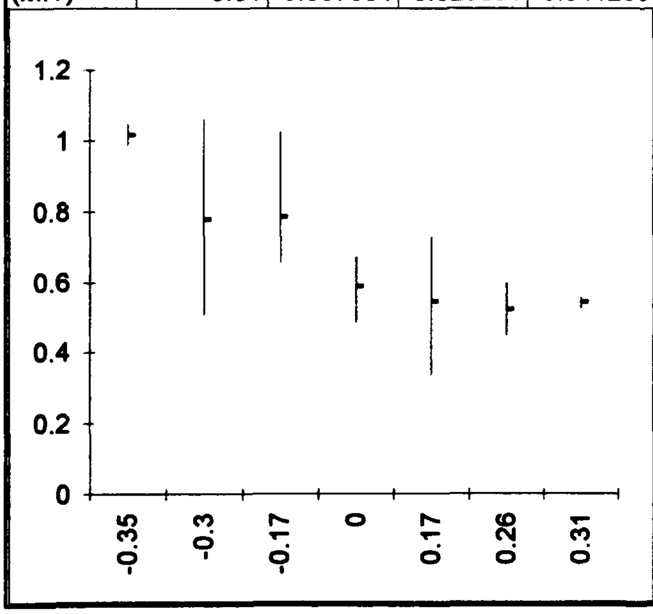
Stick#1	-0.35	1.706675	1.627325	1.667
Bot Cell	-0.3	2.017496	1.85839	1.938
15NH3	-0.17	1.967024	1.683543	1.823
Radiated	0	1.970723	1.455216	1.691
at	0.17	2.017496	0.924131	1.124
Bates Lab	0.26	1.837073	0.909016	1.368
(MIT)	0.31	1.591854	1.518147	1.555

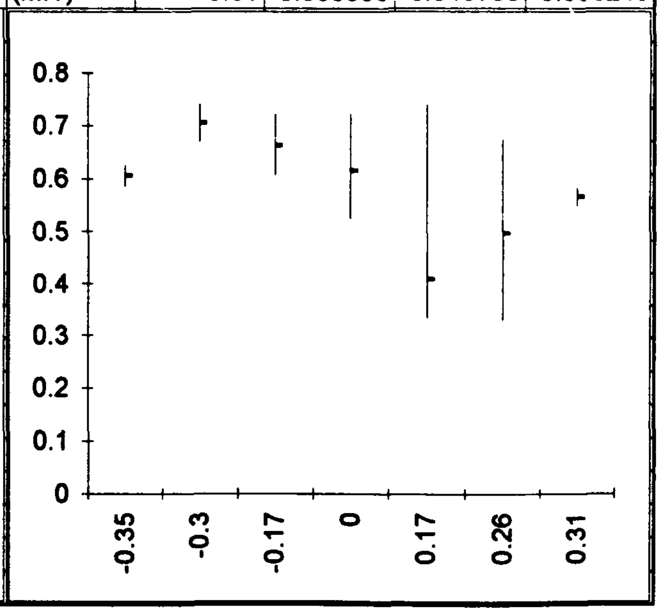




Stick#1	-0.35	1.048288	0.987058	1.017448
Top Cell	-0.3	1.062704	0.506688	0.778989
15NH3	-0.17	1.026882	0.656847	0.78626
Radiated	0	0.675815	0.484447	0.588513
at	0.17	0.730823	0.333432	0.544166
Bates Lab	0.26	0.599132	0.444894	0.520174
(MIT)	0.31	0.557664	0.525091	0.541258

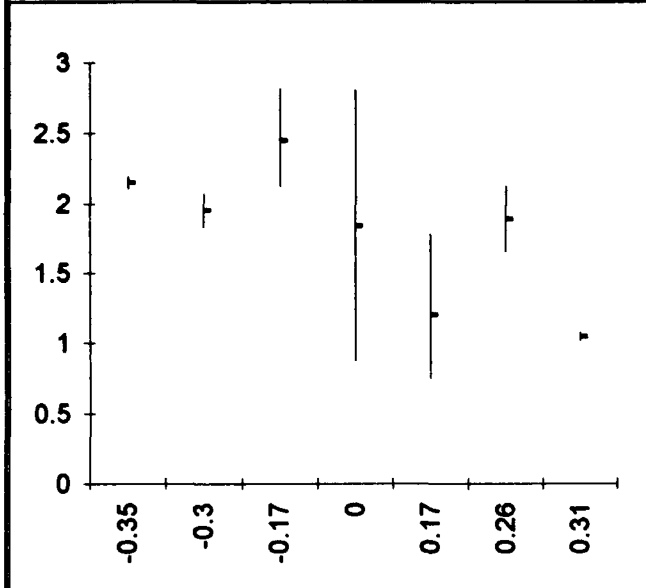
Stick#1	-0.35	0.62727	0.584985	0.605961
Bot Cell	-0.3	0.741509	0.668048	0.704471
15NH3	-0.17	0.722958	0.605194	0.662668
Radiated	0	0.724318	0.523116	0.614686
at	0.17	0.741509	0.332203	0.408579
Bates Lab	0.26	0.675196	0.32677	0.497274
(MIT)	0.31	0.585068	0.545738	0.565249

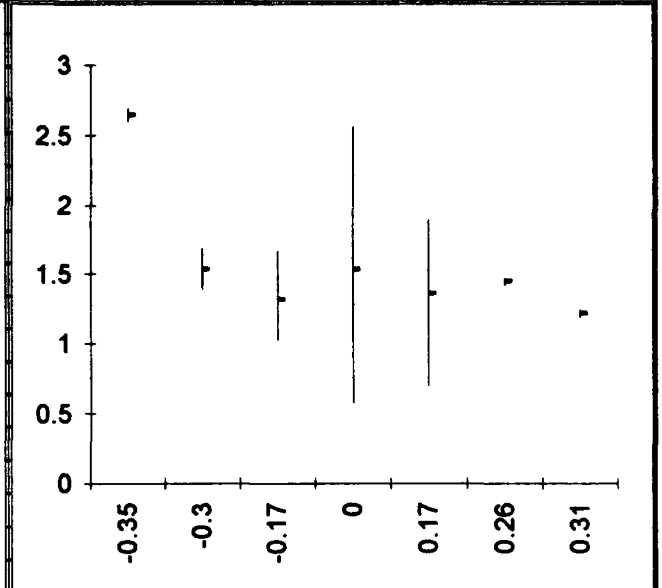




Stick#2a	-0.35	2.202357	2.101643	2.152
Top Cell	-0.3	2.079346	1.833116	1.955
15ND3	-0.17	2.82132	2.123782	2.448
Radiated	0	2.815392	0.872776	1.841
at	0.17	1.790826	0.746651	1.2
SAL	0.26	2.135189	1.648595	1.889
(Canada)	0.31	1.078426	1.013574	1.046

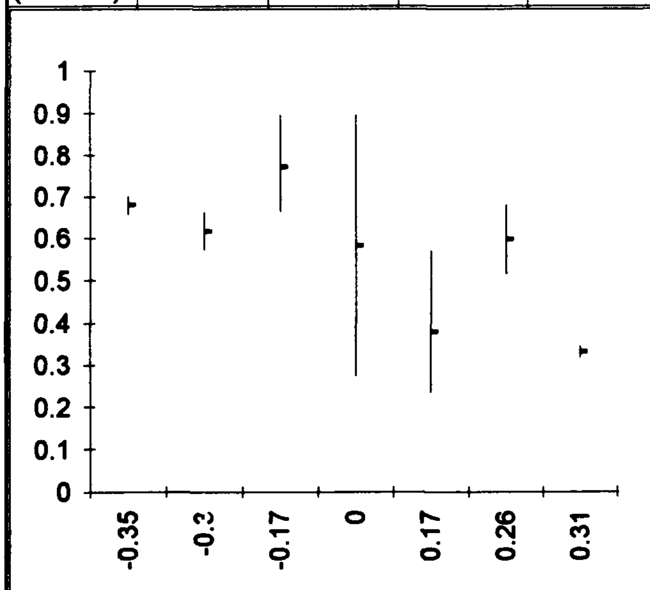
Stick#2a	-0.35	2.698577	2.597423	2.648
Bot Cell	-0.3	1.688775	1.381274	1.534
15NH3	-0.17	1.673259	1.022169	1.318
Radiated	0	2.57016	0.574774	1.533
at	0.17	1.905008	0.696056	1.363
SAL	0.26	1.480258	1.409742	1.445
(Canada)	0.31	1.251008	1.184992	1.218

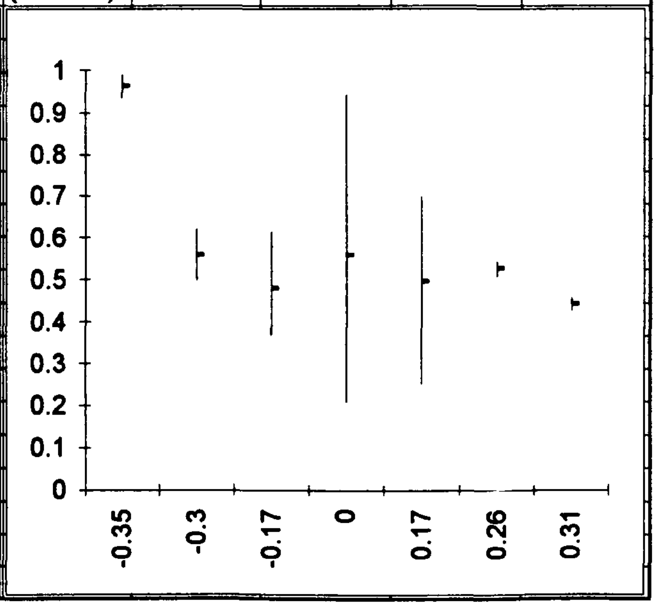




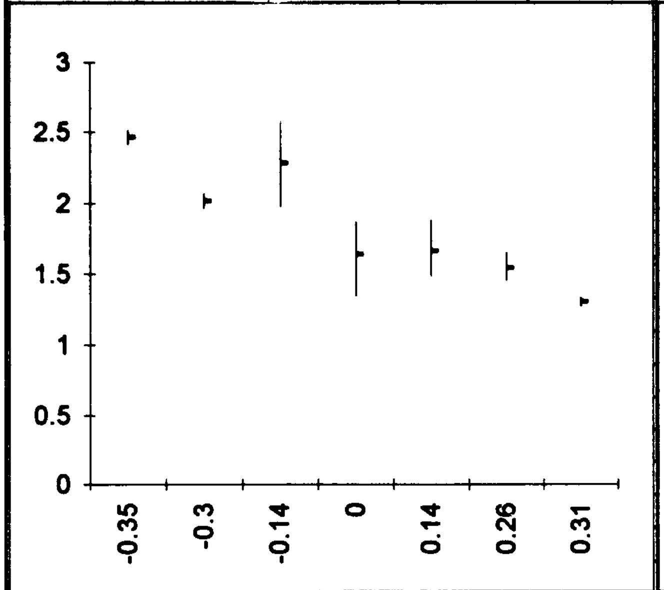
Stick#2a	-0.35	0.702835	0.656233	0.679293
Top Cell	-0.3	0.663579	0.572386	0.617109
15ND3	-0.17	0.900364	0.663145	0.772727
Radiated	0	0.898473	0.272522	0.581124
at	0.17	0.571504	0.23314	0.378788
SAL	0.26	0.6814	0.51477	0.596275
(Canada)	0.31	0.344157	0.316486	0.330177

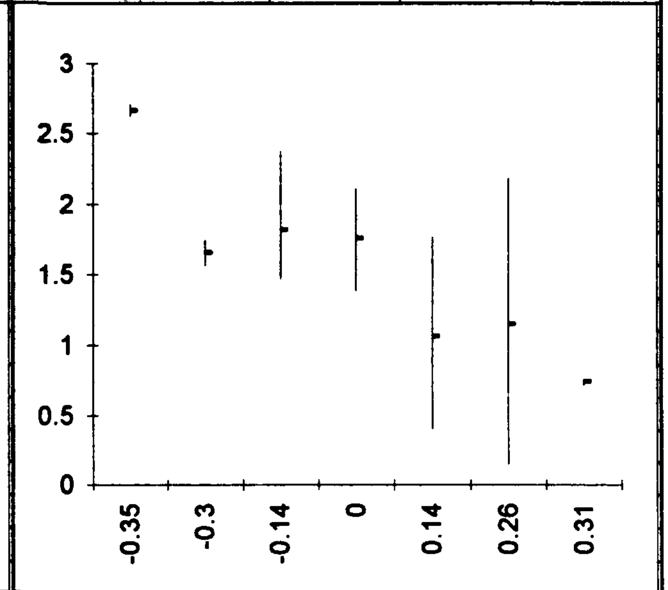
Stick#2a	-0.35	0.991832	0.933713	0.962559
Bot Cell	-0.3	0.620691	0.496536	0.557615
15NH3	-0.17	0.614988	0.367446	0.479099
Radiated	0	0.944634	0.206618	0.557252
at	0.17	0.700165	0.250216	0.495456
SAL	0.26	0.544053	0.506769	0.525264
(Canada)	0.31	0.459794	0.425977	0.442748



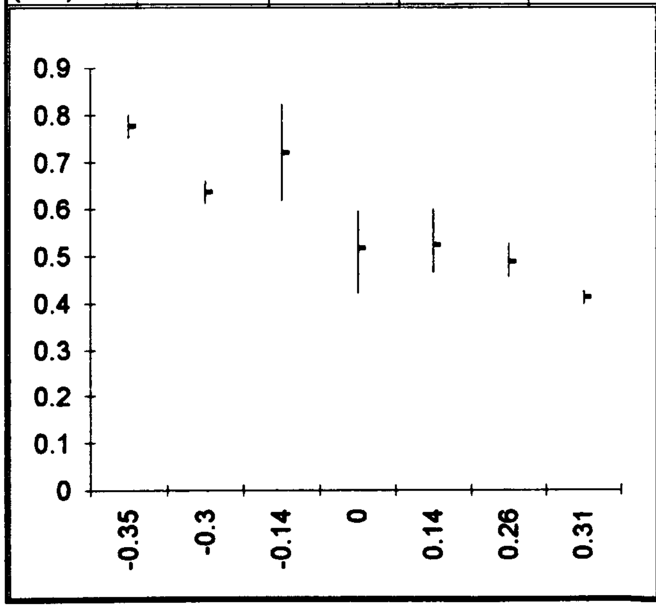


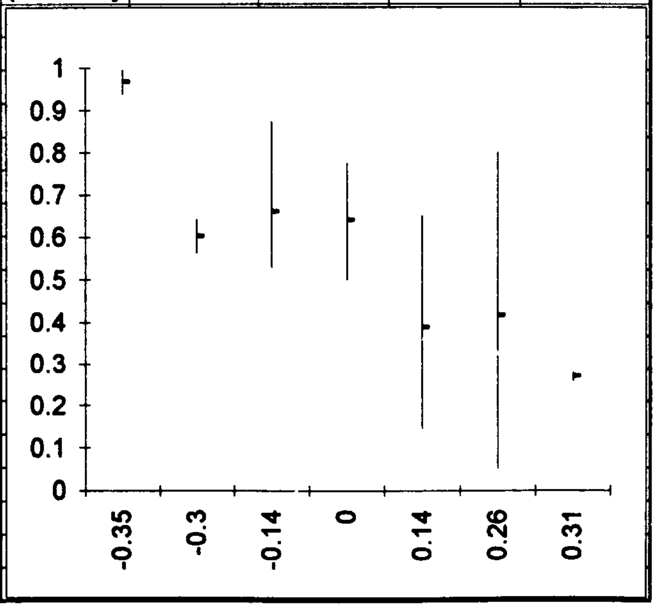
Stick#2b'	-0.35	2.517679	2.408321	2.463	Stick#2b'	-0.35	2.712844	2.611156	2.662
Top Cell	-0.3	2.074229	1.961414	2.017	Bot Cell	-0.3	1.75257	1.563566	1.658
15ND3	-0.14	2.584666	1.975662	2.283	15NH3	-0.14	2.383421	1.467145	1.818
Radiated	0	1.870592	1.345529	1.638	Radiated	0	2.115941	1.387238	1.761
at	0.14	1.884318	1.48413	1.659	at	0.14	1.774385	0.400363	1.068
Bates Lab	0.26	1.655698	1.454331	1.544	NPS	0.26	2.191443	0.141819	1.15
(MIT)	0.31	1.340512	1.267488	1.304	(Monterey	0.31	0.770359	0.719841	0.7451



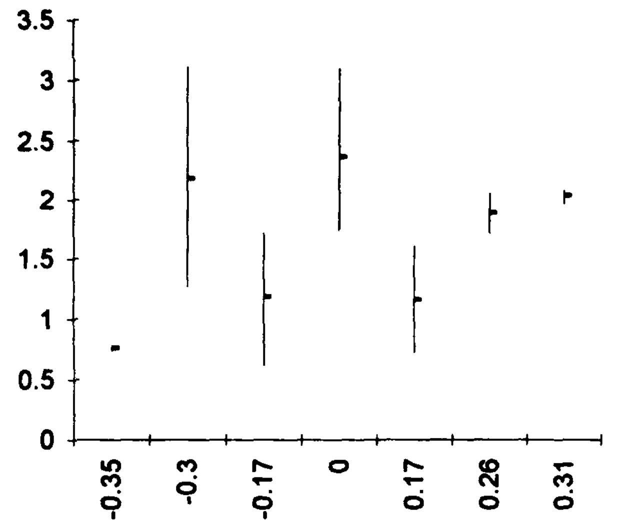


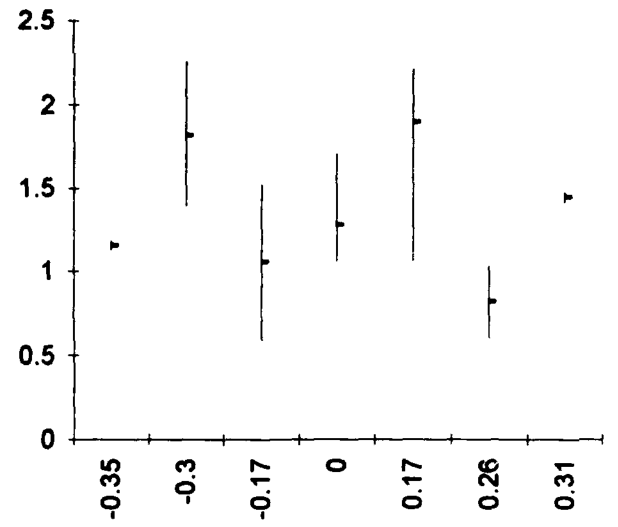
Stick#2b'	-0.35	0.803464	0.751992	0.777462	Stick#2b'	-0.35	0.997076	0.938649	0.967648
Top Cell	-0.3	0.661946	0.612447	0.636679	Bot Cell	-0.3	0.644138	0.562065	0.60269
15ND3	-0.14	0.824841	0.616895	0.720644	15NH3	-0.14	0.876	0.527404	0.660851
Radiated	0	0.59696	0.420138	0.517045	Radiated	0	0.777691	0.498679	0.640131
at	0.14	0.60134	0.463416	0.523674	at	0.14	0.652156	0.143921	0.388222
Bates Lab	0.26	0.528381	0.454111	0.487374	NPS	0.26	0.805441	0.050981	0.41803
(MIT)	0.31	0.427796	0.39577	0.411616	(Monterey	0.31	0.283137	0.258766	0.270847



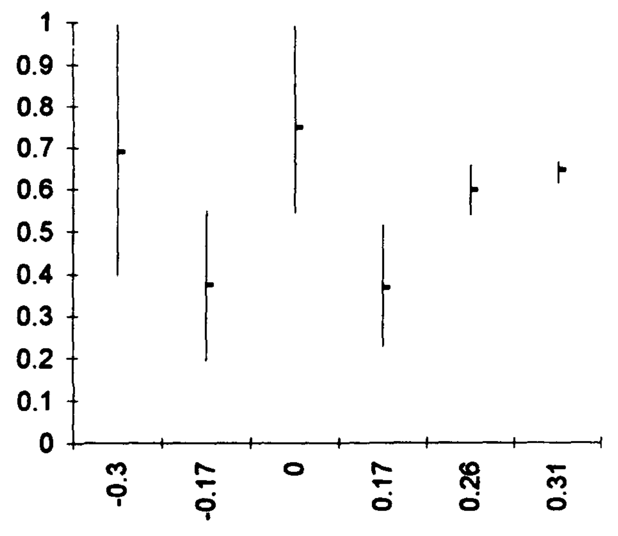


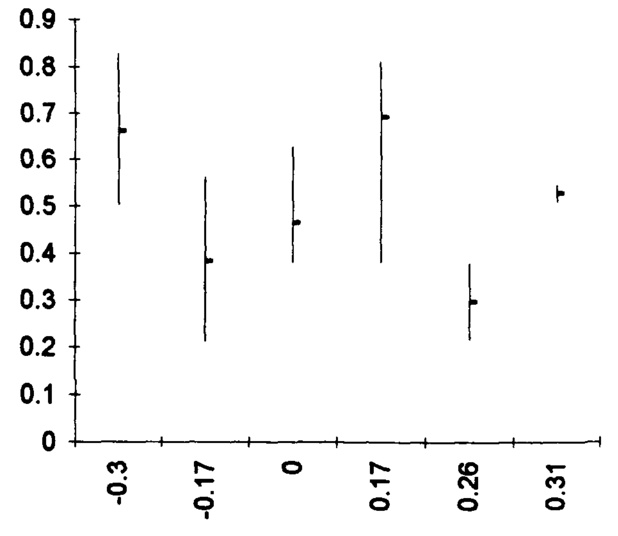
Stick#3a	-0.35	0.792983	0.735217	0.7641	Stick#3a	-0.35	1.18563	1.12037	1.153
Top Cell	-0.3	3.119259	1.264312	2.182	Bot Cell	-0.3	2.259965	1.391753	1.821
15ND3	-0.17	1.723344	0.6168	1.184	15NH3	-0.17	1.531927	0.589776	1.055
Radiated	0	3.108664	1.738526	2.37	Radiated	0	1.713525	1.054825	1.276
at	0.17	1.620907	0.724594	1.161	at	0.17	2.215353	1.053644	1.901
NPS	0.26	2.066675	1.716799	1.891	NPS	0.26	1.03618	0.601625	0.8156
(Monterey	0.31	2.088559	1.961414	2.043	(Monterey	0.31	1.486105	1.413895	1.45



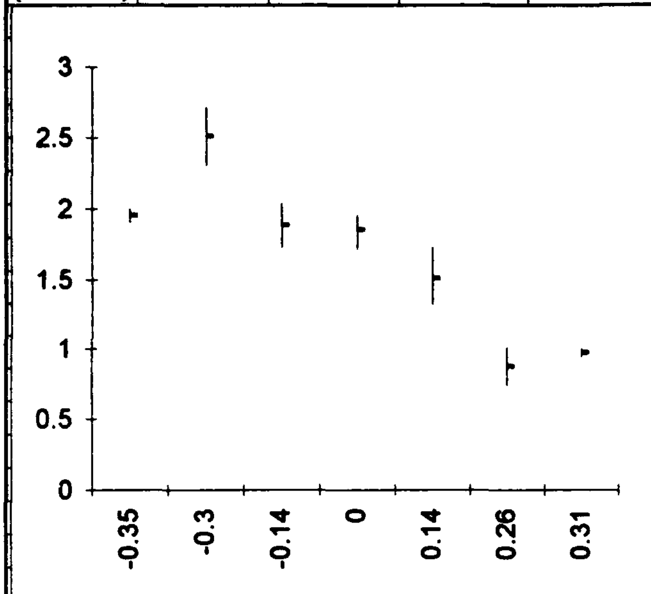


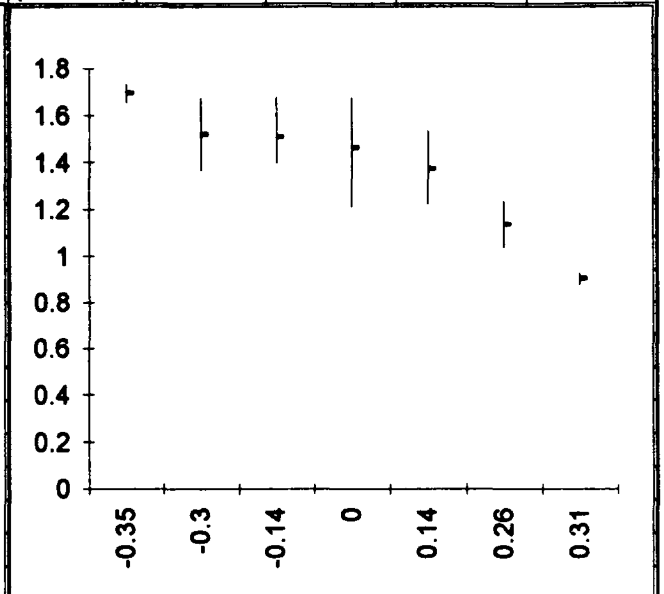
Stick#3a	-0.35	0.253064	0.22957	0.241193	Stick#3a	-0.35	0.435765	0.402747	0.41912
Top Cell	-0.3	0.995445	0.394778	0.688763	Bot Cell	-0.3	0.830625	0.500303	0.661941
15ND3	-0.17	0.549969	0.192594	0.373737	15NH3	-0.17	0.563043	0.212011	0.383497
Radiated	0	0.992064	0.54285	0.748106	Radiated	0	0.629787	0.379185	0.463831
at	0.17	0.517278	0.226253	0.366477	at	0.17	0.814229	0.37876	0.691021
NPS	0.26	0.659535	0.536066	0.596907	NPS	0.26	0.380837	0.21627	0.296474
(Monterey	0.31	0.666519	0.612447	0.644886	(Monterey	0.31	0.546202	0.508262	0.527081



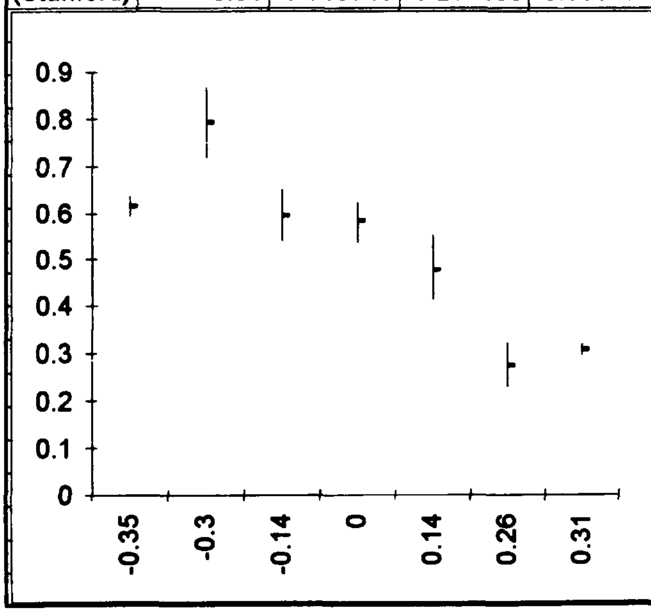


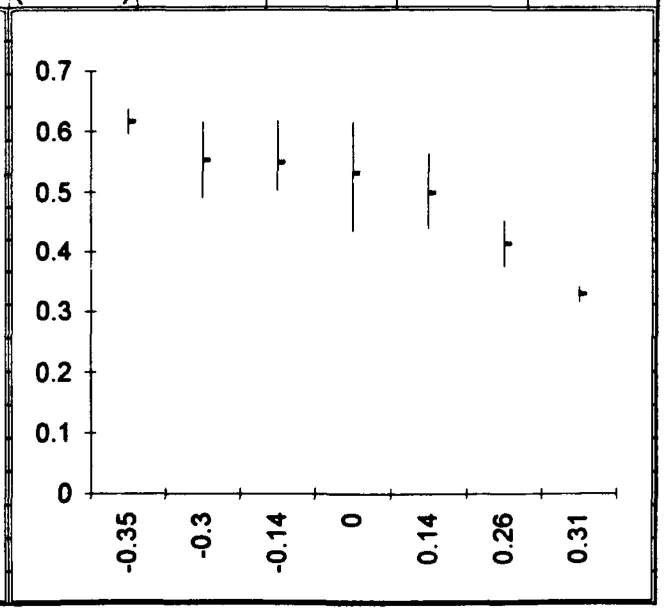
Stick#3b'	-0.35	2.001434	1.904566	1.953	Stick#3b'	-0.35	1.736704	1.655296	1.696
Top Cell	-0.3	2.722599	2.304404	2.513	Bot Cell	-0.3	1.678579	1.366115	1.521
15ND3	-0.14	2.043904	1.728763	1.885	15NH3	-0.14	1.68501	1.396057	1.509
Radiated	0	1.96026	1.713856	1.854	Radiated	0	1.679196	1.210389	1.462
at	0.14	1.737875	1.320112	1.51	at	0.14	1.538471	1.220547	1.372
HEPL	0.26	1.010576	0.732108	0.87	HEPL	0.26	1.240313	1.038756	1.138
(Stanford)	0.31	1.001926	0.941674	0.9718	(Stanford)	0.31	0.932784	0.877217	0.905





Stick#3b'	-0.35	0.638715	0.594696	0.616477	Stick#3b'	-0.35	0.638307	0.59504	0.616503
Top Cell	-0.3	0.86886	0.719544	0.793245	Bot Cell	-0.3	0.616943	0.491086	0.55289
15ND3	-0.14	0.652269	0.539802	0.595013	15NH3	-0.14	0.619307	0.50185	0.548528
Radiated	0	0.625575	0.535147	0.585227	Radiated	0	0.61717	0.435106	0.531443
at	0.14	0.554606	0.412202	0.476641	at	0.14	0.565448	0.438758	0.498728
HEPL	0.26	0.322504	0.228599	0.274621	HEPL	0.26	0.455864	0.373408	0.413668
(Stanford)	0.31	0.319743	0.294035	0.306755	(Stanford)	0.31	0.342834	0.315339	0.328971





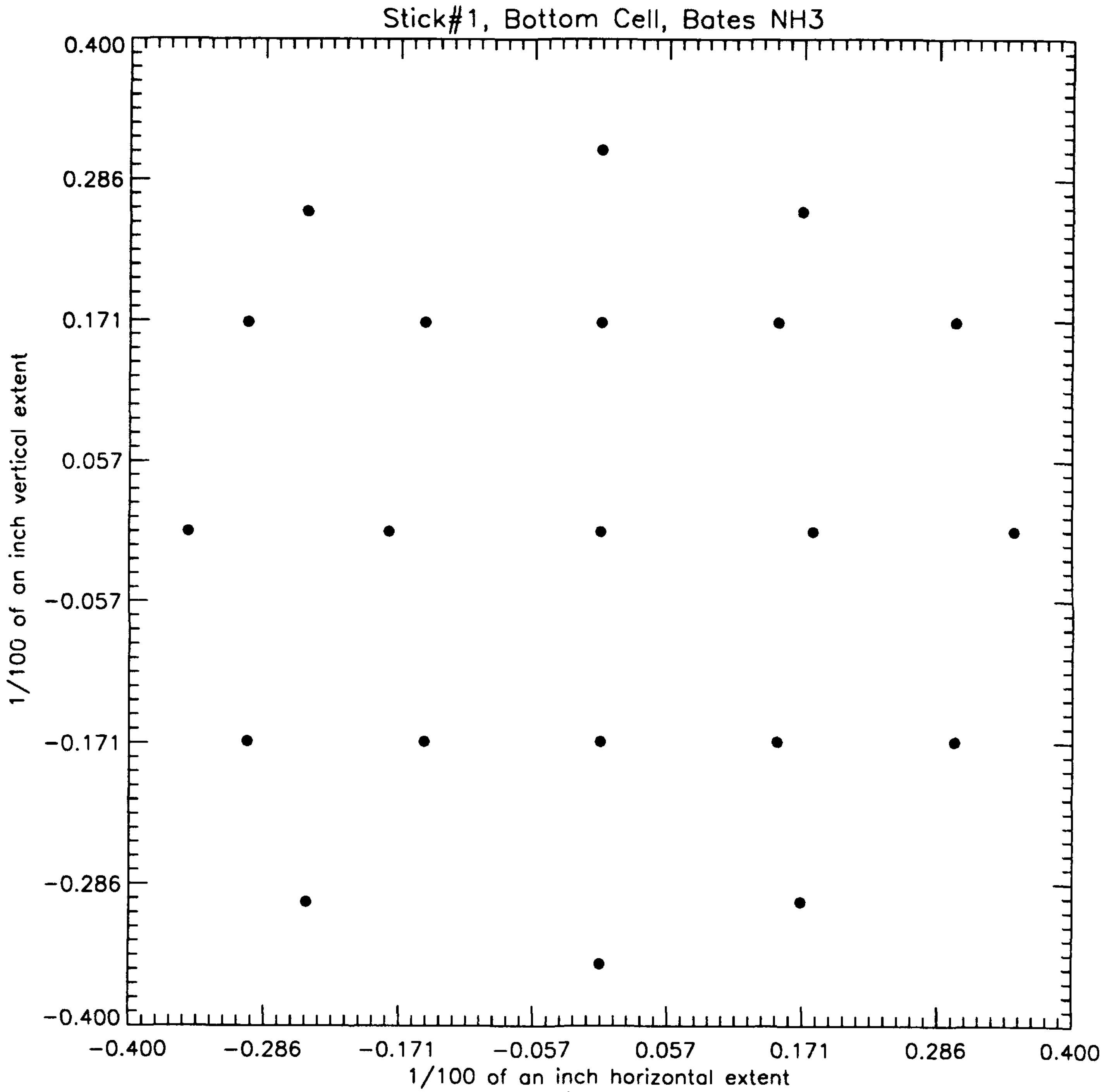
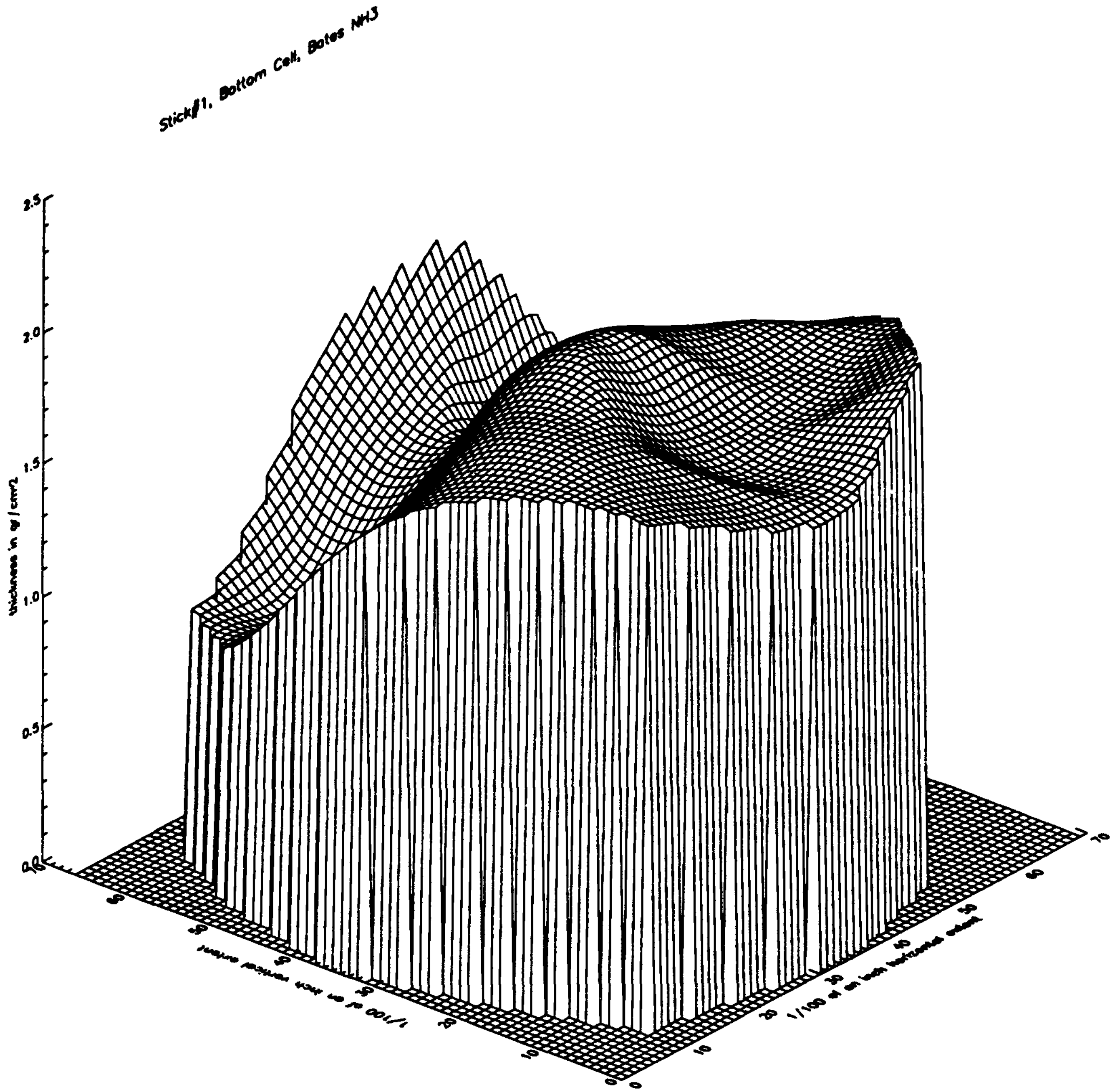
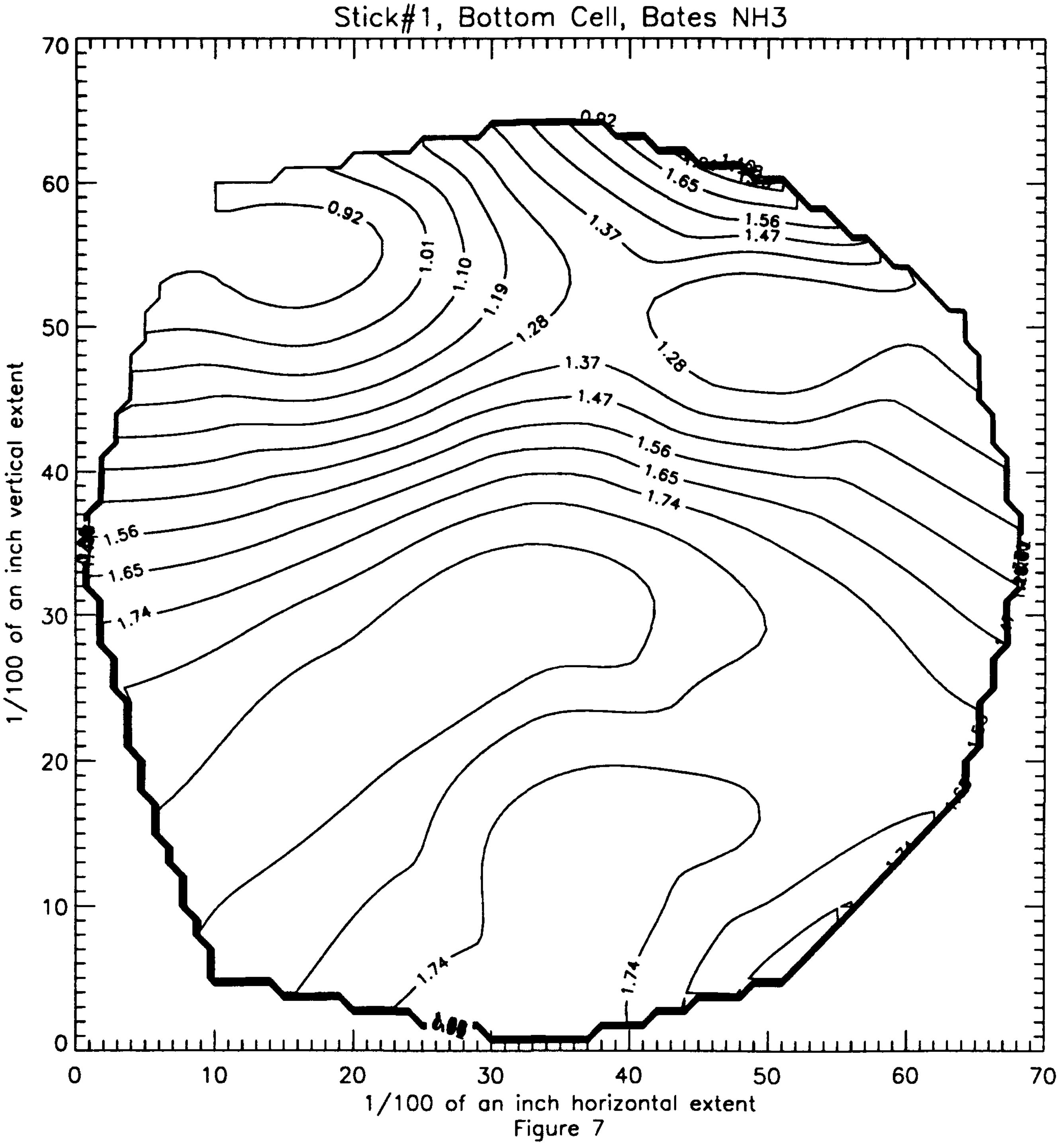
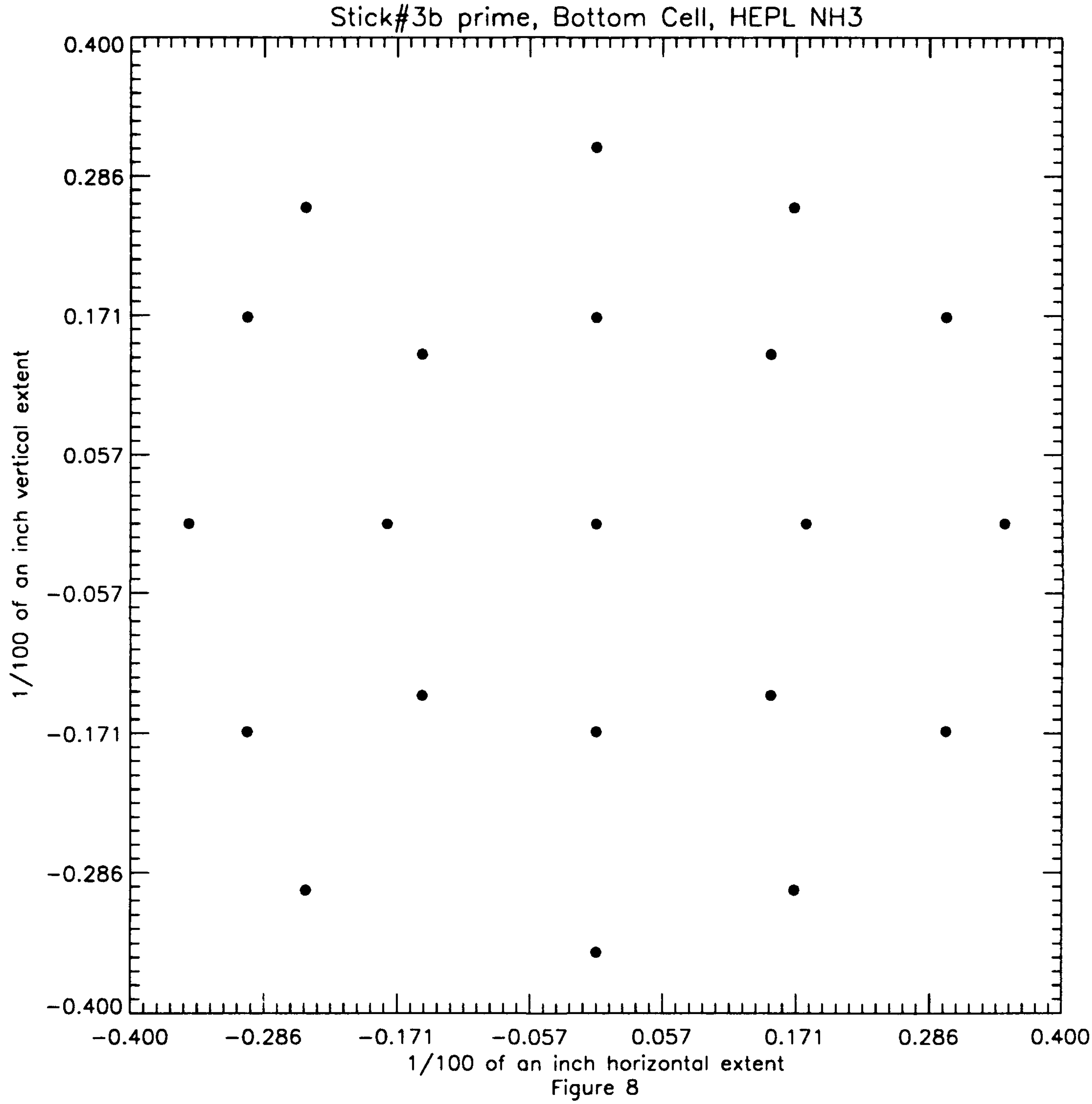
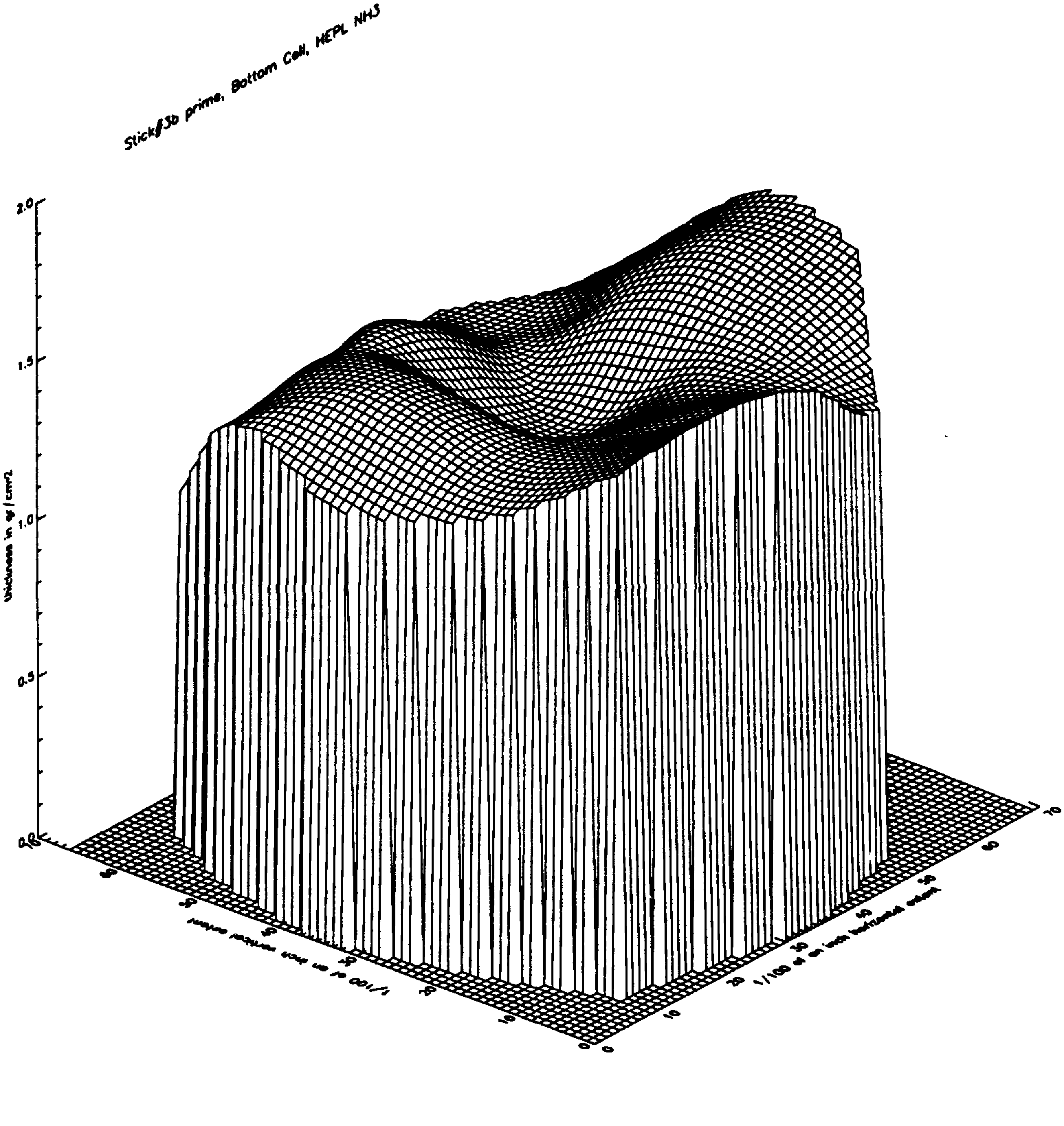

Stick#1, Bottom Cell, Bates NH3
0.400
0.286
0.171
0.057
−0.057
−0.171
−0.286
−0.400
1/100 of an inch vertical extent
−0.400
−0.286
−0.171
−0.057
0.057
0.171
0.286
0.400
1/100 of an inch horizontal extent

Figure 5

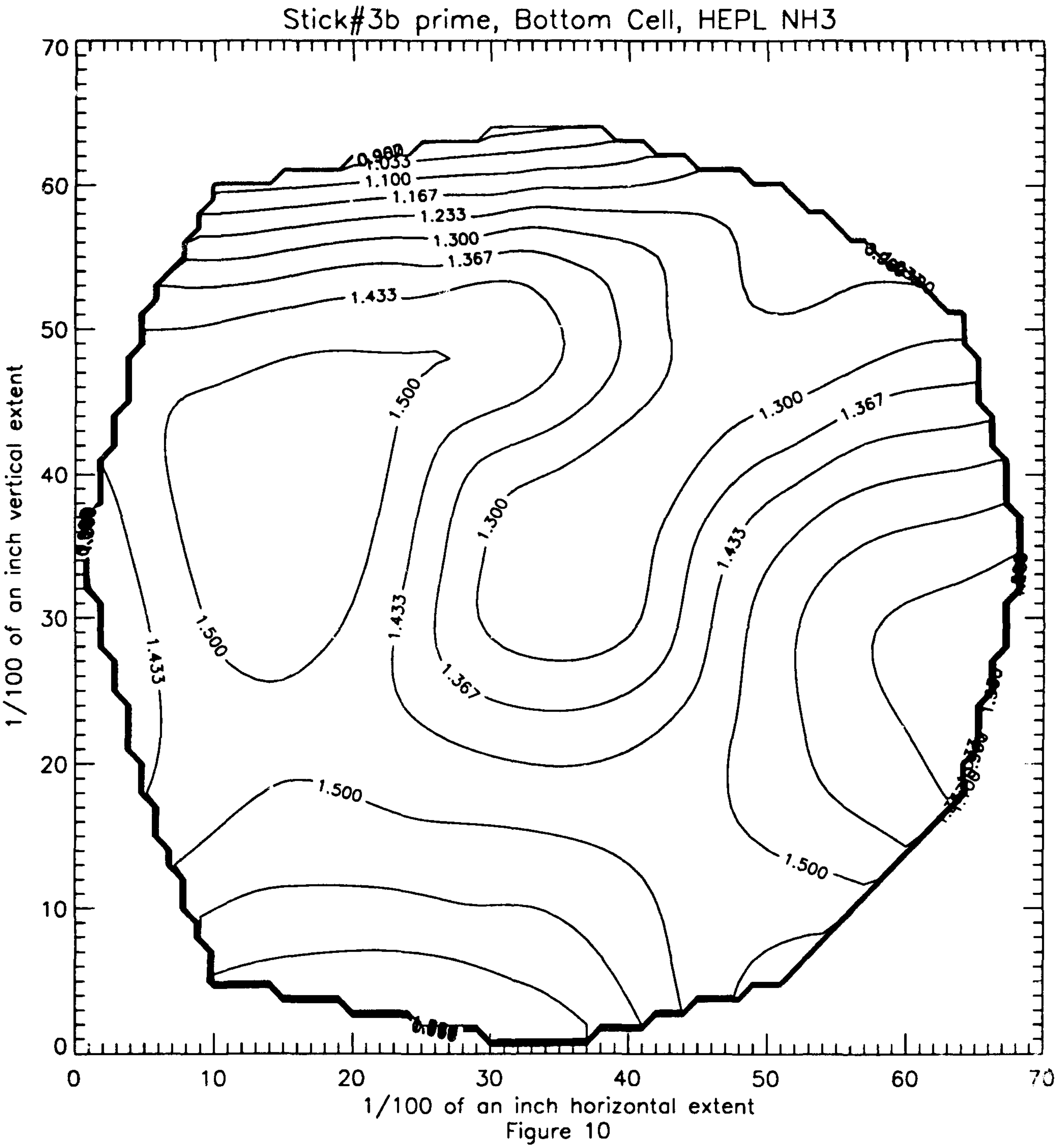

Stick#1, Bottom Cell, Botes NH3
thickness in g/cm^2
2.5
2.0
1.5
1.0
0.5
0.0
1/100 of an inch vertical extent
1/100 of an inch horizontal extent
0
10
20
30
40
50
60
70


Stick#1, Bottom Cell, Bates NH3
1/100 of an inch vertical extent
1/100 of an inch horizontal extent
0.92
1.01
1.10
1.19
1.28
1.37
1.47
1.56
1.65
1.74
Figure 7


Stick#3b prime, Bottom Cell, HEPL NH3
0.400
0.286
0.171
0.057
-0.057
-0.171
-0.286
-0.400
1/100 of an inch vertical extent
-0.400
-0.286
-0.171
-0.057
0.057
0.171
0.286
0.400
1/100 of an inch horizontal extent
Figure 8



Stick#3b prime, Bottom Cell, HEPL NH3
thickness in g/cm2
2.0
1.5
1.0
0.5
0.0
1/100 of an inch vertical extent
1/100 of an inch horizontal extent


Stick#3b prime, Bottom Cell, HEPL NH3
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
1/100 of an inch vertical extent
1/100 of an inch horizontal extent
1.033
1.100
1.167
1.233
1.300
1.367
1.433
1.500
1.300
1.367
1.300
1.433
1.500
1.433
1.433
1.367
1.500
1.500
Figure 10

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